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The ELECTRICAL REVIEW

FOUNDED 1872

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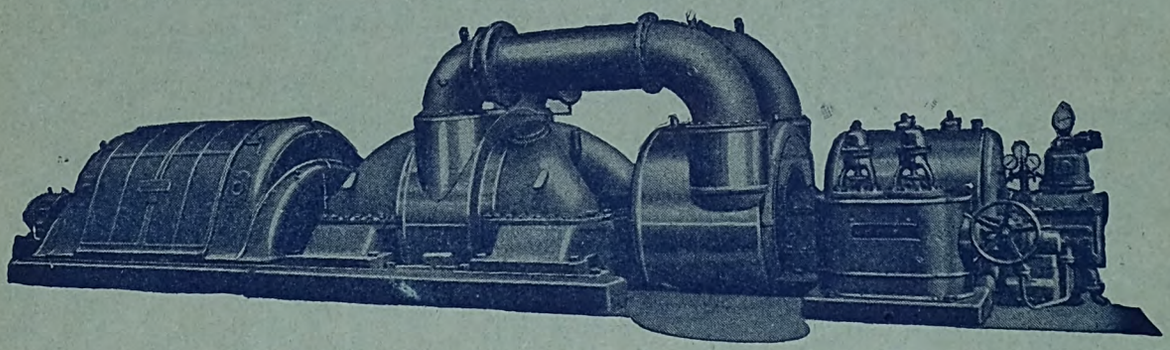

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The
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Trade in South America.

THE members of the British Economic Mission are now on their way back from South America, having left by the M.V. *Asturias* last week for Southampton. Lord D'Abernon "confesses," says *The Times*, that he is much impressed by the possibilities of Brazil, a confession which thousands of British traders have expressed for a score of years. Further back than that and all the while since, our foreign trade travellers have had no hesitation about the matter and have said so in the ELECTRICAL REVIEW and other trade journals. It has become quite wearisome to hear many such things and to read them in official reports. Everybody seems to know that there are great opportunities in the whole of Latin-America, but they are wonderfully encouraged to hear their views repeated by an official authority sent to spy out the land. Lord D'Abernon, studying the position as it is to-day, says that fidelity to a fixed standard of currency is the only path of wisdom and safety. Of course the Mission had a delightfully warm reception everywhere—we should have been surprised if it had not been so, even after the activities of Mr. H. Hoover last year. The Mission's report will be awaited with interest because the members are reported by *The Times* to be returning home "with every confidence that benefit will accrue to Anglo-Brazilian trade."

It is gratifying to read in a dispatch that one outcome of the tour was the conclusion of a provisional trading agreement with Argentina, the principal object of which is to provide that during the next two years the Argentine Government shall take approximately £8,000,000 worth of British manufactures for railways and other public works in return for the purchase, through trade channels, of Argentine food products to a similar value.

It will be quite useful to learn what the British Mission has to say concerning the effect of American activities in Latin-America. In this connection we may quote from an important communication dealing with this subject, which appeared in the *Frankfurter Zeitung* (July 28th), from a New York correspondent. The writer says that the object of the financial penetration of New York companies is to obtain an active management in Latin-American undertakings, high prices being paid to get control over them according to valuation of the future possibilities of development. It will be remembered that during and before the war the word "pene-

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tration " as used against German foreign traders was uttered with a shudder as though relating to an abomination, and all sorts of stories hung around it here and in most pro-British papers and amongst most observers. It is viewed more or less with equanimity with regard to Germany now, but seemingly even less wrath is generated by reference to American penetration—it is almost entertaining to some, while others speculate where it will end and what the consequences will be. The *Frankfurter Zeitung* report says that the policy of American expansion in Latin-America is naturally greatly facilitated by the extraordinary wealth of the United States and the good credit which is enjoyed by the great American electrical concerns at the back of the holding companies which are pressing forward in Latin-America. In particular, attention is directed to the largest holding company of South American electrical securities—the American & Foreign Power Co. This company, which in its turn is controlled by the Electric Bond & Share Co., closely associated with the American General Electric Co., has now after five years' activity become an important factor in American economic life. Having started with the Cuban Electric Co., the American and Foreign Power Co. is credited with controlling on September 30th, 1928, 7,800,000 ordinary shares and 850,000 preference shares in some 38 electricity supply undertakings in South America, while further acquisitions have been made in the meantime. The latter include the share control in the Argentine properties of the Atlas Light & Power Co., Ltd., and of Mexican companies taken over from the Northern Mexico Power and Development Co., Ltd. Similarly active in Latin-America is the International Telephone and Telegraph Corporation.

It is not only in the financial direction, the correspondent says, that the Americans are very active, but also in the matter of advertising. The practice is to erect imposing buildings and arrange showrooms and demonstrations in order to attract customers for electrical apparatus. In this connection it is mentioned that the United States' exports of electrical appliances in common use, excepting telephone apparatus, are greater than ever before and were valued at $110,000,000 last year, of which the greater part was sent to Latin-America.

The above comments still further excite our impatience to know what our own Commission will say.

The Operation of the Grid.

The Central Electricity Board, in carrying out a difficult task has, we think, shown its wisdom in taking the electrical public into its confidence at every opportunity. Mr. A. Page set the standard in his presidential address to the Institution of Electrical Engineers in 1927, and, as a result of experience gained in the Central Scotland Scheme, Messrs. Johnstone Wright and C. W. Marshall gave a very frank exposition of the constructional features in their paper before the Institution last winter. In May last the occasion of the first annual report of the Board was used to give an interesting summary of technical progress, and this has been followed by two further important papers, one by Mr. J. R. Beard before the E.H.P. Conference in Paris, the other by Mr. C. H. Merz before the British Association at Johannesburg. We give elsewhere in this issue some extracts from the widely ranging paper by Mr. Beard, which has been previously referred to in the report of the E.H.P. Conference which appeared in the Electrical Review of July 12th, p. 65. The extracts include a disquisition on protective gear, and we think it should be emphasised that we are in this country as much ahead in this, under conditions of overhead line transmission, as we were in the past when relatively short lengths of cable only had to be considered.

Another item dealt with in the paper that will be of more than academic interest to supply engineers is the elaborate provision for metering energy necessitated by statutory regulations. In many cases the problems presented to the meter manufacturers have been extremely difficult of solution, but it is clear that they have risen to the occasion.

One more point of importance may be touched on—and herein, perhaps, lies our moral. The Board has decided not to put down its own telephone lines, but to rely on the Post Office system. It could, no doubt, have made out a case for the former course on the ground that so large and important an undertaking should be self-contained. This is the argument so often advanced by large industrial works in favour of retaining generating plant, when a supply at the same, or even lower, cost could be obtained from the public mains. The Board, in deciding against isolation, has set an example to the industry of the wider outlook.

Electricity for the Home.

Recent enterprise at Barnes, to which we refer in our second " Electricity for the Home " section in this issue, has, in particular, brought out two points of special interest. One is the practicability of thermal off-load storage schemes with really low charges, and the other is that the all-electric (one coal fire) house can be a proposition acceptable to both the supply undertaking and the small householder.

Admitted that the Barnes undertaking is favourably placed as regards service to a middle-class residential district, we do not think that that counters the business acumen that has resulted in the specially advantageous terms to the consumers.

It has been shown repeatedly in our columns that 0.33d. per kWh (off-peak) can be made a commercial proposition to the progressive undertaking, and when it is realised that the scheme provides the householder with 20 gal. of water per day at 180 deg. F. for a very reasonable expenditure, there is every reason why " three units a penny " should become a popular cry.

The cost figures given for the all-electric (one coal fire) houses will prove of special use and dispel many doubts. Even with coal as an extra, £25 for all services cannot be described as excessive. How many small householders can limit their total coal, gas and electric light bills to 10s. per week? The average cost figure shown for the all-electric houses of £9 14s. is one that might easily turn the scales in favour of electricity.

Reliable information as to the actual costs in respect of all-electric houses is scarce, and we welcome the co-operation of our readers in this matter at all times.

The Effect of the Towers.

On Friday last *The Times* contained pictures purporting to show " the effect of the Towers " by representing a 132-kV transmission line against the background of the country side at Offham. If the grid towers and lines could look as the artist has depicted them, we must confess our own views would be different from what they are. The legend under these illustrations informs us that the spacing proposed was 300 yards, in which case the height of the towers must be many times the 80 ft. stated, while their breadth is similarly exaggerated. The conductors which, actually, slightly exceed three-quarters of an inch in diameter, are almost as clearly visible at a mile and a half away as they are for the first span from the point of observation, where it would appear that their size should be measured in feet rather than in inches.

It may be that this result is due not so much to the artist's ignorance of perspective and proportion as to his membership of a school that has a contempt for realism; if so, he should not have been commissioned to illustrate a material problem.

It is clearly stated in the description text that " the pictures have been prepared by the opposing authorities "; but, unfortunately, many people seeing them in *The Times* may be disposed to regard them as having some relation to truth. We believe the route selected by the Central Electricity Board to be essential to the scheme and can only hope that the public will not be misled by so gross a distortion of the situation.

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S.H.P.

Electricity as Applied to Farming.

Some of the applications of electric power to agricultural operations, its advantages, and comparative cost.

By M. I. WILLIAMS-ELLIS, A.M.I.M.E., A.M.I.E.E., A.M.I.Mech.E., M.S.A.I.E.

VERY little attention has been paid to this subject in this country, as compared with the attention given to it in many other countries. During the past ten or fifteen years the cost of agricultural production, like most other industries, has increased considerably, while at the same time, due to severe competition, the price of farm products has not advanced in the same proportion. Consequently, it would appear that the necessity of decreasing the cost of general agricultural production is of predominant importance.

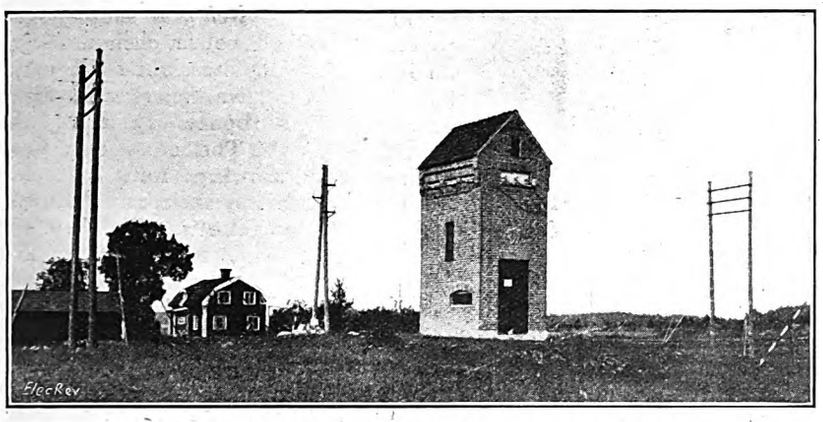

Fig. 1.—Rural Transformer House in Sweden.

Manual labour, so far as is possible, must be replaced by labour-saving mechanical devices. Although it is a mistake to imagine that mechanical, or electrical, machinery will cause all ills in the agricultural industry to be cured, still such machinery is going to be an important factor in its ultimate salvation. In this country about 500 farmers are using electricity in one way or another, while in Sweden upwards of 52,000 farmers use it.

Private individuals in this country have done a great deal in exploring the possibilities of the full application of electricity to farming, and it may well be stated that Mr. R. Borlase Matthews has championed the cause for its application more than anyone else, in the fact that he has carried out more research work in this direction and applied electricity in a practical way to farming. He has certainly practised what he has preached, and no better example of the application of electricity to farming can be given than that on his farm at East Grinstead. The Institution of Electrical Engineers has furthered this branch of engineering to a great extent by its report of 1925, while its special committee has done further excellent work in this direction. In this country the application of electricity to farming has been slow for many reasons, and one may consider the chief reasons to be the following :—

(1) Centralisation of industries.
(2) Absence of distribution schemes.
(3) High cost of supply.
(4) General lack of interest in rural reconstruction.

Under the banner of " back to the land " something further may be done for the electrification of our rural industries, but that alone will not be enough; one must have the co-operation of the experts, the engineer, farmer, manufacturer, and distribution companies with the outside support of the Government and local authorities, the latter in a practical and non-political way, together with the avoidance of all " red tape."

The uses to which electricity can be applied to agriculture are many, and under each heading careful consideration is necessary; the main headings are as under :—

(1) *Motive power*, for electric ploughing gear and driving general farm machinery, such as chaff-cutters, grinders, pumps, threshing machines, dairy plant, shearing, sawing, crushing, root pulpers, hay and crop elevators, milking plant, crop dryers, &c.

(2) *Lighting*, for house, farm buildings, and poultry houses.

(3) *Heating*, for cooking, hot water supply, laundry work, sterilisers, and incubators, &c.

(4) *Stimulation of crops by electro-culture*, under which come the treatment of seeds and treatment of plants by intensive illumination.

There is little doubt that in the near future greater strides will be made in the application of electricity to farming under the above headings, and will become more and more generally applied, as it has in other industries; and will be the means of reducing costs and increasing the output of our agricultural industry generally.

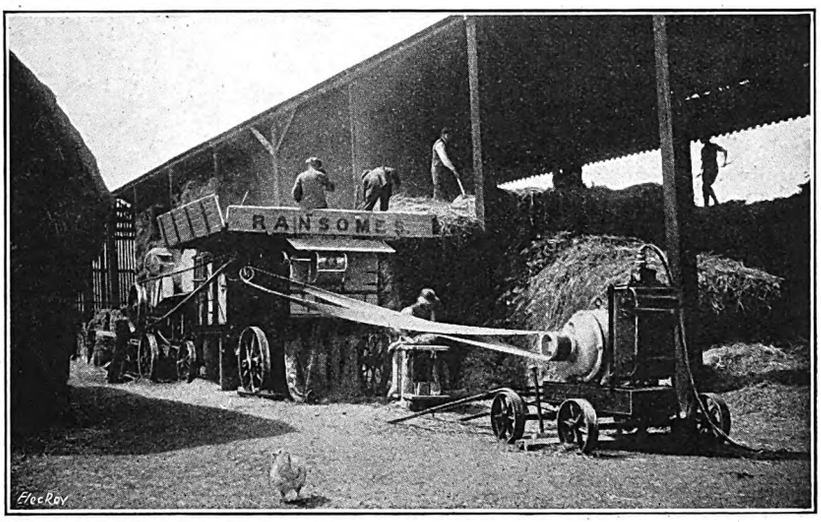

Fig. 2.—Larger Portable Motor.

One of the first essentials in the direction of stimu-

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lating electrical farming is cheap electricity and a well planned distribution scheme, assuming that in the latter case farms are not equipped with their own electrical generating plant.

The financial aspect in this direction rests with the generating station and distribution company engineers, while there are many points in connection with electrical farming that may well be catered for, with advantage to all. It is true that in some districts such engineers are doing much, but greater energy is required in most cases, even to the education of the farmer in the use and application of electrical machinery.

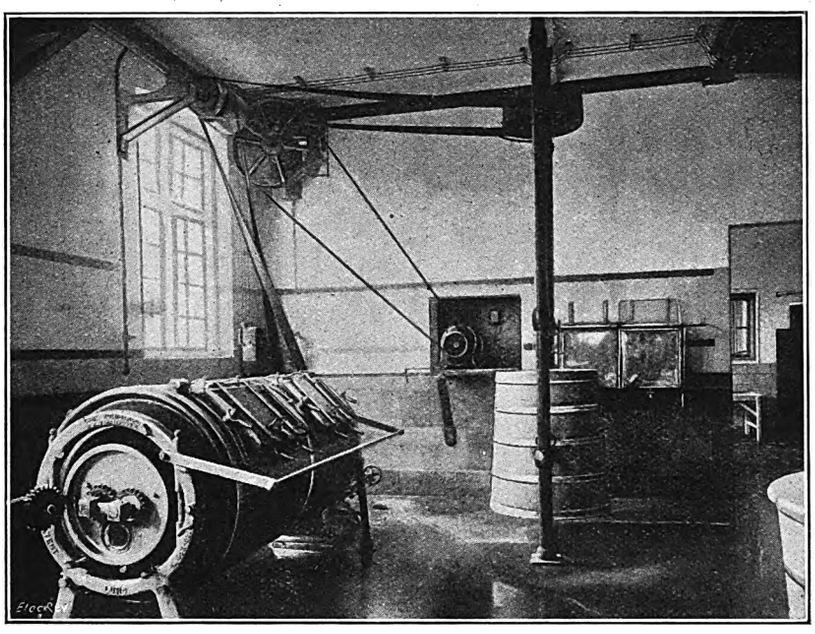

Fig. 3.—An Electrically-driven Dairy.

From the station engineer's point of view, load factor is one of the chief points with which he is concerned, and it is interesting to note that in this direction figures are given of from 13 per cent, up to as high as 55 per cent. in connection with the use of electricity on different classes of farms, which in itself is far more satisfactory than an engineering works with a load factor of 17 per cent. approximately.

The data obtained from countries where great strides have been made in rural districts in connection with the application of electricity to farming are indeed interesting reading; the chief countries concerned being America, Canada, New Zealand, Australia, Japan, Sweden, France, Germany, and Italy. It would appear that a good supply of electricity in rural districts would not only be of benefit to the farmer directly, but also indirectly, as it would stimulate local industries and would act as a checking force to the deplorable migration from country to town, and be a means of affording an economical opportunity of paying wages to the country worker that are comparable to the town industrialist.

Fig. 1 shows a rural district transformer house in Sweden for agricultural work.

Design of Electrical Machines for Farm use.—

It is under this heading that manufacturers can do a great deal in the matter of designing machines for actual farm use, the essentials being ruggedness in conjunction with simplicity and low first cost, which applies equally to the electrical and mechanical portions of plant, as the farmer has little or no time to spend on repairs and overhauls.

Electric motors on a three-phase system are usually of the squirrel-cage type, as it has many advantages, the chief of which are simplicity, mechanical and electrical strength, while other attractive features are low first cost and little maintenance. The chief disadvantage is, of course, small starting torque, but as farm machinery is generally started under light load, such motors are eminently suitable for such work, wound-rotor motors being used where they have to start against full load. For a d.c. supply shunt motors are usually adopted.

In all cases the machines are totally-enclosed, drip-proof, or enclosed ventilated, as dust, dirt, and moisture have all to be guarded against in connection with agricultural work, not to mention the acid and ammonia fumes that have to be contended with when manure is present. It is for these reasons that all windings should be very carefully vacuum impregnated. The lubrication should be simple, fool-proof, and allow for motors to work at different angles, ball bearings giving the best results.

The switch gear should be simple, fool-proof, of robust design, and mounted in an iron watertight case, while it is often advantageous to have the actual starting gear embodied in the frame of the motor. The size of motors may vary from ¼ b.h.p. for such work as cream separators, shearing apparatus, churns, and the like, up to 60 or 120 b.h.p. for ploughing. The more or less standard sizes in general use may be taken as ¼, ½, 1, 2, 3, 5, 10, 15, and for ploughing up to about 80 b.h.p. Small motors of a portable type have been a good deal used, while for these special gearing is often installed to give very low speeds when required in connection with different class of plant to be driven. Such a motor is shown in fig. 5 as supplied by Messrs. Ransomes. The motor has three driving shafts running at different speeds, and two different special pulleys are provided, so that nine different speeds are obtained without changing the pulley on the driven machine.

Another type of portable machine of standard design and of greater output by the same maker for such work as threshing is shown in fig. 2. The B.T.H. Co. has designed a special range of motors for farmers' use, and one of its neat portable sets is shown in fig. 7; the motor is rated at 5 b.h.p., 400/440 volts, three-phase, 50 cycles, fitted with a 5½-inch pulley, and provided with 40 ft. of 3-core c.t.s. cable with an earth core. Generally most farmers, when first installing electricity, pre-

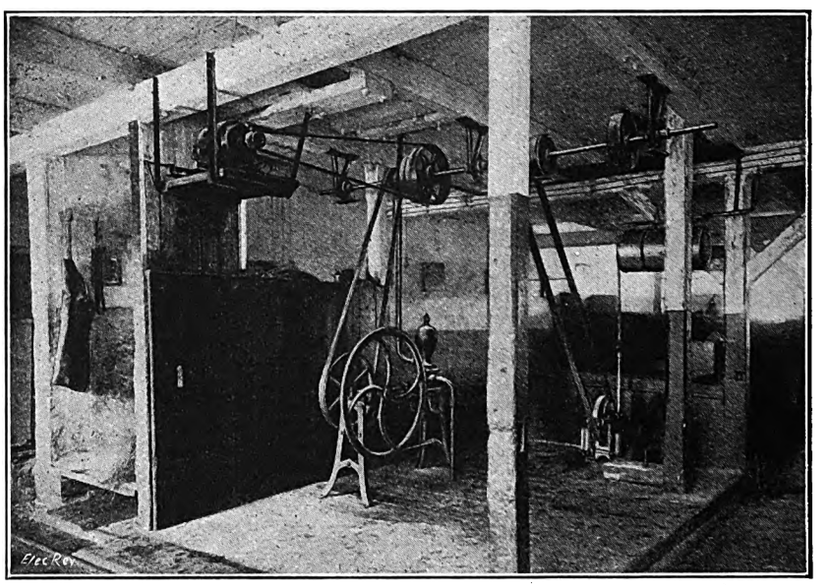

Fig. 4.—Electric Dairy Air Pump.

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fer a portable motor, so as to be able to use it on a number of different machines with as small a capital outlay as possible; after a short time they so fully appreciate its value that they gradually, as finance permits, install individual motors for each machine, or group of machines. Fig. 8 shows a B.T.H. unit drive for an oats crushing machine, by a 7½ b.h.p., 950 r.p.m., 400/440 volts, ventilated, squirrel-cage type motor.

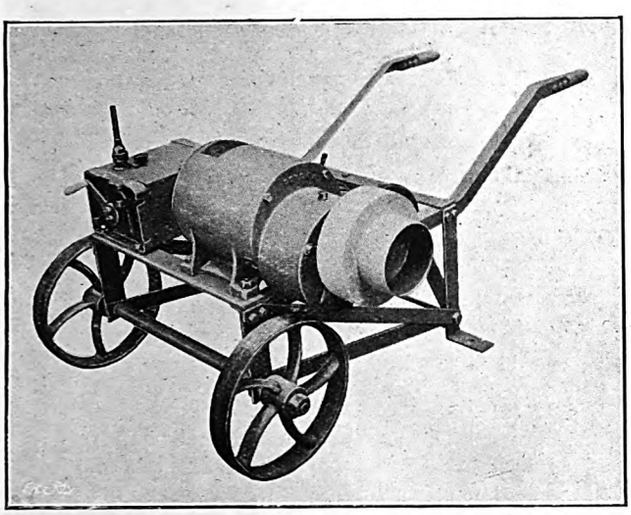

Fig. 5.—Small Portable Motor.

The main power supply is now always alternating, three-phase, generally at high voltages. It can easily be transformed to the voltage required for farm distribution and for driving motors. When power is taken from the supply authority's mains in this way, it is probable that the junction point will have to be at one place, even if the mains pass right across the estate. Where power is taken off, a small sub-station will have to be fitted up, including a transformer, &c. In connection with ploughing and the like, a portable sub-station is often employed in connection with a "flying" line, and a common practice on the Continent is to make connection with, say, a 30,000-volt line by the simple method of hanging hooks direct on to the line. The more fool-proof and safer method, however, also employed, is to use pole contacts as shown in figs. 10 and 11 which are operated from the ground as shown.

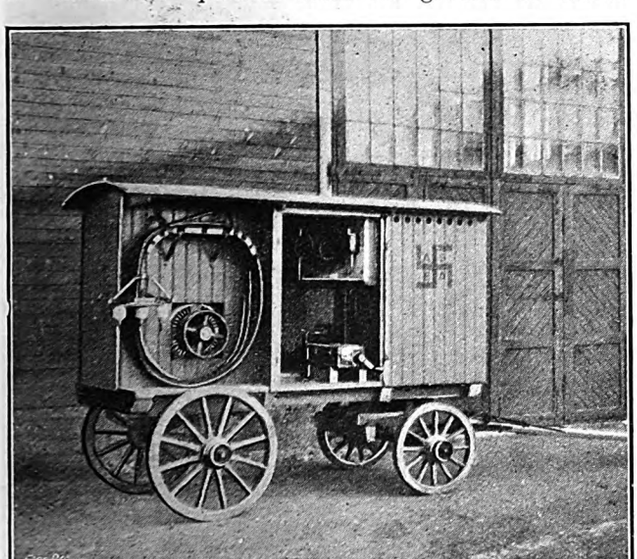

Fig. 6.—A Transportable Sub-station Wagon.

Fig. 9 shows a farm transformer of 5 kVA capacity, 3,000/400 volts, mounted on wooden poles for supplying the small units.

Fig. 6 shows a portable sub-station supplied by the Asea Electric Co., Ltd., mounted on a wagon with motor, h.p. connections, transformer, and switchgear.

Cables and wiring.—For overhead lines the best system is bare copper, tappings being taken off for the different buildings and led in through the walls through porcelain tubes. The wiring inside the buildings should be a first-class steel-tube system, which is admittedly the most expensive system; the tubes should also be coated with impregnated hemp so as to resist the action of the moisture and acid fumes, &c. Plain lead-covered wiring is not often recommended, except in very dry places. A system used abroad, which gives excellent results, is to run the bare-copper wiring along inside under the roofs, mounted on porcelain insulators; this system is the cheapest and less likely to give trouble than any other from an insulation point of view, as one must always bear in mind that in stables and the like one has not only to contend with moisture, but also the deleterious effects arising from ammonia and acid fumes, so that ordinary house wiring is of no use in such cases. The writer has found that a good class of c.t.s. or "Maconite" cable, when placed on insulators, has given excellent results for the above work.

Fig. 3 shows an electrically-driven dairy and the method of wiring, while fig. 4 shows an electric motor driving an air pump for milking machines and water pump.

For connecting up motors, &c., and for trailing cables, c.t.s. cables provided with an earth core give excellent results.

Switches for internal work are best of the overhead type, operated by turning handles, or the inverted rotary type with drip protecting porcelain shield, the latter being used in preference to the tumbler type switch.

Lampholders should be of porcelain, or the all composition type, preference being given to the screw type lampholder and lamp for specific reasons.

Consumption.—An approximate estimate of the energy that would be consumed on a farm of about 150 acres is as follows:—

Lighting house	...	...	120 kWh per annum
Lighting buildings	...	...	150 " " "
Motive power	...	...	1,500 " " "
Heating and cooking	...	...	1,600 " " "
Total	...	...	3,370

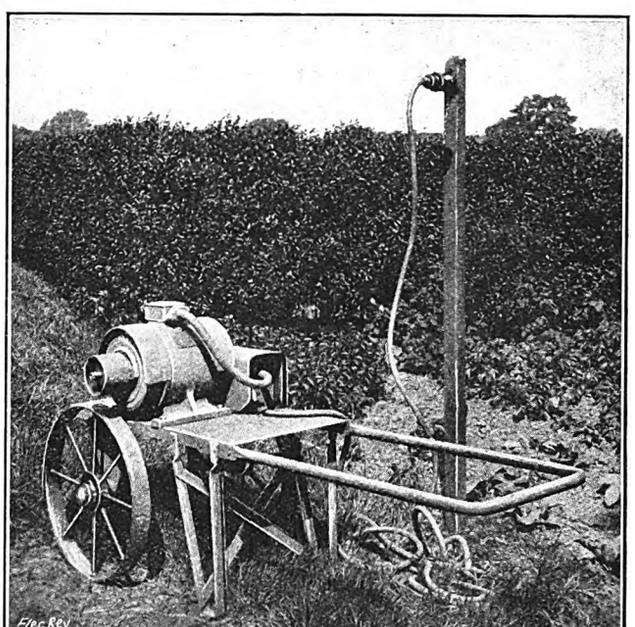

Fig. 7.—Transportable Electric Motor.

In a special report of the I.E.E. it is interesting to note that the consumption per acre of 33 farms in a certain supply area is given as 9.5 kWh, but statistics of use on Continental farms which have used electricity for several years, show a higher consumption than this, averaging 22 kWh per acre, while in the North-East of Germany the consumption may average (without electric ploughing) as high as 100 kWh per acre.

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The outputs indicated in Tables I and II are based on those obtained when the electric motor is working at full load, but there are times when the motor is not required to work at full load. On those occasions, an electric motor is very much more economical than any type of oil engine, as it only consumes electricity directly in proportion to the work it is doing, while an

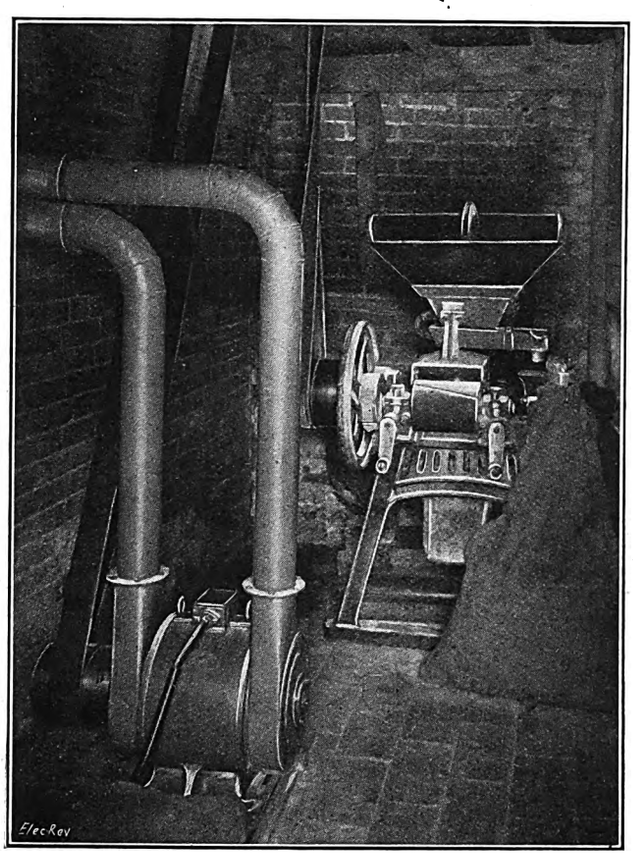

Fig. 8.—Oats Crushing Machine.

oil engine consumes practically the same amount of fuel whether it is running at full load or running light. If either a 2- or 5-b.h.p. electric motor is operated continuously at full load, it will consume nearly two or five kW per hour, respectively. The electric motor, however, unlike nearly all other sources of power, is very sensitive to any reduction in load, so that the consumption per hour in practice averages out at just over a third of a kWh per horse power (much depending on the nature of load), *i.e.*, just over two-thirds of a kWh for a 2-b.h.p. motor and one and two-thirds of a kWh for a 5-b.h.p. motor.

TABLE I.—Two Horse-power Agricultural Motor.

Machine.	Speed of machine per minute.	Approximate capacity of machine per hour.
Chaff Cutter ...	200	12 cwt. ¾ in. chaff.
Grinding Mill .	550	4 Bushels soft meal. 6 „ medium meal.
Corn Crusher	150	16 Bushels Oats. 26 „ Beans, Peas, or Maize. 40 „ Malt.
Cake Breaker ...	100	28 cwt.
Root Pulper ...	80	2½ tons.
Root Grater ...	180	4½ tons.
Kibbling Mill ...	550	15 Bushels.
Milking Machine	—	Milk 100 cows (6 cow plant).
Saw Bench ...	1,000/1,300	6½ in. depth of cut.
Pumps	1,400	2,000 gallons per hour, total head 100 feet.
Ball-bearing, non-finishing thrashing machine ...	—	40 Bushels Oats.

Most electricity supply authorities supply energy for power purposes at a price of 3d. or 4d. per kWh, or less, so that, assuming electricity can be obtained at 3d. per kWh and taking the figures for average consumption stated, the cost of running the 2-b.h.p. motor for one hour will be approximately 2d., and the 5-b.h.p. motor 5d. These figures indicate that a considerable saving can be made by substituting electric power for both man and animal power.

Electric Ploughing.—Under this heading very little has been done in this country when compared with what has been done in other countries, although it is the most important load on a farm from the point of view of the power supply engineer. A well-known system is that of Messrs. Fowler, of which a description will not be out of place. The system is known as the "Fowler electric cable ploughing tackle." As the

TABLE II.—Five Horse-power Agricultural Motor.

Machine.	Speed of machine per minute.	Approximate capacity of machine per hour.
Chaff Cutter ...	200	38 cwt. ¾ in. Chaff.
Grinding Mill ...	500	10 Bushels.
Corn Crusher ...	200	20 Bushels Oats. 50 „ Malt. 20 „ Linseed. 30 „ Beans, Peas, or Maize.
Kibbling Mill ...	500	25 Bushels.
Ensilage cutter and blower ...	700	8 tons.
Cake and biscuit breakers and Pulverisers ...	450	12 cwt.
Saw bench ...	800/1,000	10 in. depth of cut.
Pumps	1,400	4,000 gallons, to al head of 150 feet.
Ball-bearing, finishing thrashing machine 6 ft. drum	—	45 Bushels.

available power in the great majority of cases will be alternating current, provision is made for a transformer to be carried on the back of the engine. This arrangement at once simplifies the installation, because

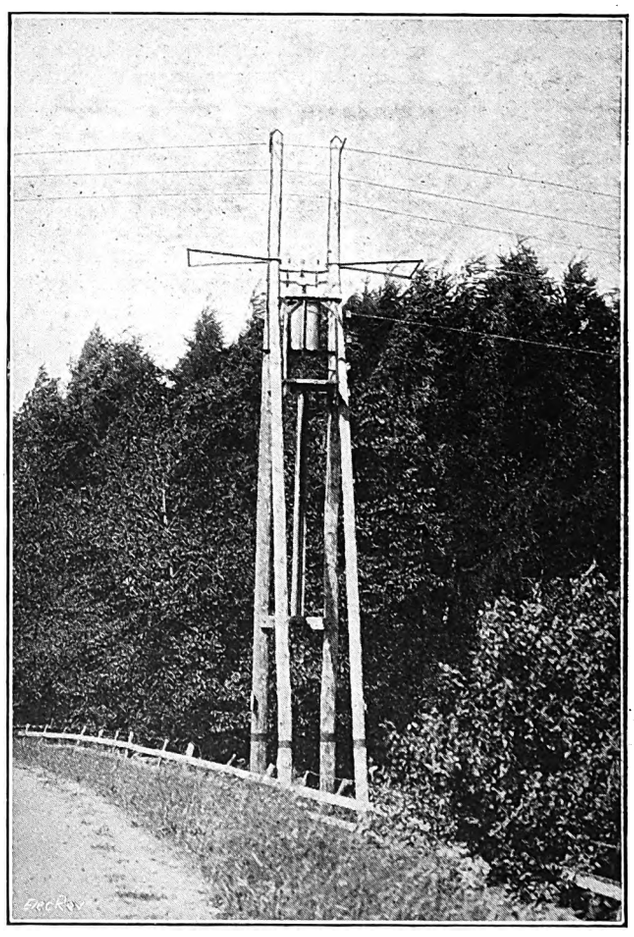

Fig. 9.—Pole-mounted Farm Transformer.

the power can be brought through the overhead wiring and flexible cable at an economical voltage, of, say, 2,000-3,000 volts and transformed down on the engine itself to a suitable working voltage for the motor, which eliminates any danger to the driver, and also enables standard motors to be used. In addition to the electric driving motor, which is of the slip-ring induction type,

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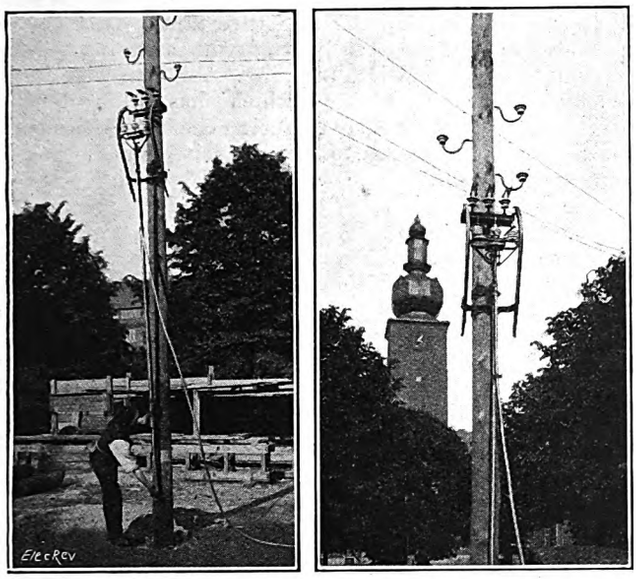
a 4-cylinder engine of small power is fitted for moving the plant about from place to place when not coupled to the electric power. Both electric motor and petrol engine drive the same gearing and are arranged to operate either the ploughing gear or the road gear. Two running speeds can be arranged on the motor by



Figs. 10 and 11.—Pole-line Tapping Contacts.

alteration of the number of poles, and two sets of bevel gear can also be fitted for ploughing, giving a range of four different speeds to suit varying loads and soils. In general, the Fowler electric hauling engine is similar in design to the Fowler steam and motor-ploughing engines, with a horizontal drum carried underneath the frame for carrying 450 to 600 yards of rope. The frame is of deep steel plates strongly reinforced to carry the shafts and gearing, and also to house the electric motor and petrol engine. All controls are brought back to the driver's footplate at the rear of the vehicle. The flexible cable is carried on the drum at the rear of the hauling engine, fitted with hand winding gear for coiling it up again after it is paid out.

Relative Costs and Comparative Economy.—In comparing the working costs of steam, motor, and electric cable tackles, the difficulty is at once experienced that electrical ploughing requires considerable outlay on permanent equipment, the cost of which varies in each individual case. Electrical ploughing machinery, implements, and hauling engines, with their flexible cables, will cost approximately the same as a set of internal combustion tackle, and perhaps 10 or 15 per cent. more than a similar set of steam tackle. To this must be added the cost of the overhead wiring, which one can estimate roughly at 10s. per acre for a regular and freshly laid out estate, and also the cost of the main sub-station, transformer, switches, &c. The actual running costs comparison is simple: for English ploughing in medium soil about 20 kWh of electricity, or 100 lb. of good coal, or 2¼ gallons of petrol, are required per acre. In addition to the cost of coal, about 1s. per acre must be added for the cost of hauling water and 5s. per ton for hauling the coal; ½d. per gallon may also be estimated as the cost of delivering petrol or other engine fuel.

On this basis it is easy to compare the running cost of ploughing or cultivating by the various systems. In addition, however, the extra initial cost of installing the electrical power has to be considered in any particular case, except in instances in which it is carried out by an electric power company and included in its charge for power.

New Switchgear.

Some notes on a fully automatic Crompton Parkinson oil circuit breaker without current transformers or series trip coils.

A NEW oil circuit breaker developed by Crompton Parkinson, Ltd., and named the Crompton "T.A.P." breaker, possesses features which seem to be quite new in oil circuit-breaker design and, it is claimed, offer important advantages. Briefly, it consists of a breaker of normal design, which is tripped by the fusing of any one of the three fuses which are carried under the moving crossbars of insulating material. On an overload or fault the circuit is interrupted by the fuse, and the complete disconnection of all phases at the switch contacts follows instantly. The advantages claimed for the innovation are:—

The break is quicker than that of any ordinary circuit breaker operated by current transformers and the usual tripping mechanism.

The fault, or overload, current is interrupted by a fuse, followed by two further breaks in series at the switch contacts, thus providing three breaks in series per phase. The fault current is always interrupted by the fuse. The amount of metal fused is limited, and damage to switch contacts is avoided.

No current transformers are required, and therefore the "T.A.P." breaker can be used on small-capacity circuits supplied by trunk lines, where current transformers of low primary rating would have insufficient mechanical strength, or thermal capacity, for safe use. The fuse can be set to operate with reliability at as low a current as 2½ amperes.

The switch portion follows conventional oil circuit-breaker design and has a high rupturing capacity. The switch contacts are protected from severe fault conditions, however, by the fuses, which introduce an additional and exceptionally rapid break. As a result, the rupturing capacity is higher than that of an ordinary oil circuit breaker of similar size, the standard unit being rated nominally at 75,000 kVA, but that figure,

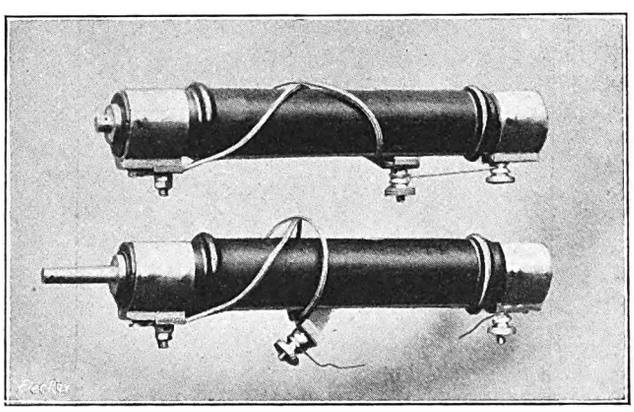


Fig. 1.—Fuse Carriers Intact (above) and Blown (below).

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it is believed, does not represent the limit of its capabilities.

The new breaker must not be confused with switch-fuses, or similar fuse devices, which may open on individual phases and leave a three-phase system connected to two lines only. When one fuse blows the three phases

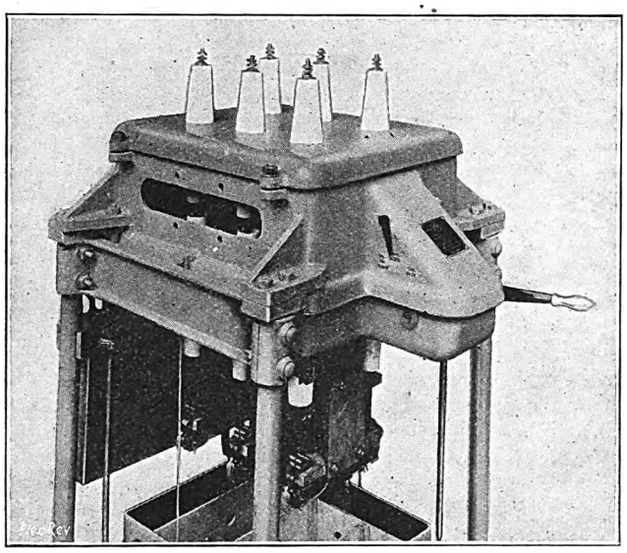

Fig. 2.—Cover Removed, showing Isolating Plug Contacts.

are tripped instantly, and the breaker cannot be re-closed until the blown fuse has been renewed.

A drop-down isolating device is incorporated, which by a continuation of the normal opening movement completely isolates the switch portion and the fuses, and the breaker cannot be closed unless all fuses are sound and the tank is on. This feature permits the replacement of fuses with complete absence of danger to the operator, and removes any possible objection to the use of a trip-

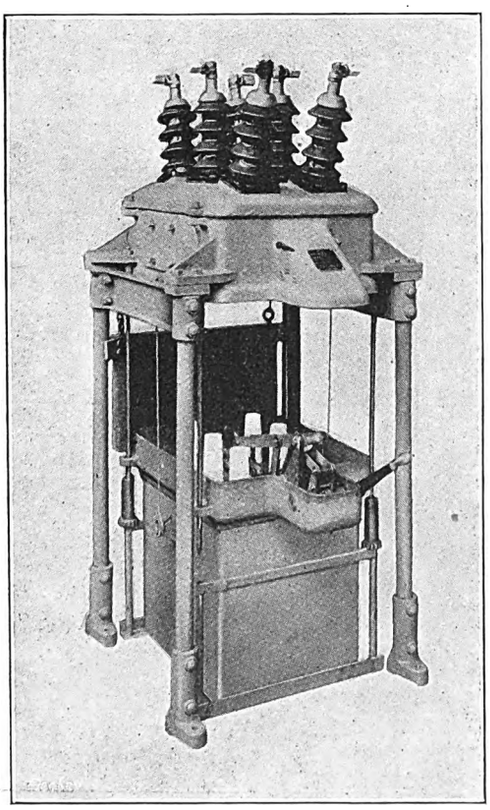

Fig. 3.—Breaker with Switch Lowered.

ping device which is normally at line voltage. It is, of course, clear that the operating bar, which is actuated by the fuse and causes the trip mechanism to operate, is made of high-grade insulation material.

The general construction of the "T.A.P." breaker is shown in the accompanying illustrations. The automatic feature is obtained by means of a spring-loaded fuse, the fuse wire holding a spring in tension while intact and releasing it when melted, the plunger operated by the spring then actuating the tripping mechanism. A patented lever device is incorporated in the fuse unit which relieves the fuse wire of almost all strain and enables a strong spring to be kept extended with a pull just sufficient to keep the fuse wire taut. This device enables fine fuse wires to be used with a spring strong enough to ensure positive tripping. The fuse wire itself consists of a special alloy, which has high tensile strength and does not alter its fusing characteristics even when heated repeatedly to nearly fusing point, cooled, and heated again.

The isolating device is of the drop-down type with interlocks, as mentioned above. In the action of closing the breaker the isolating contacts, which are attached at their lower end to the upper of two crossbars, engage in sockets mounted in insulators in the terminal plate above the switch top. Continued movement of the closing mechanism compresses a spring between the two crossbars and closes the switch contacts; this spring acts as an accelerating spring to ensure a rapid break on opening. Continued movement of the operating

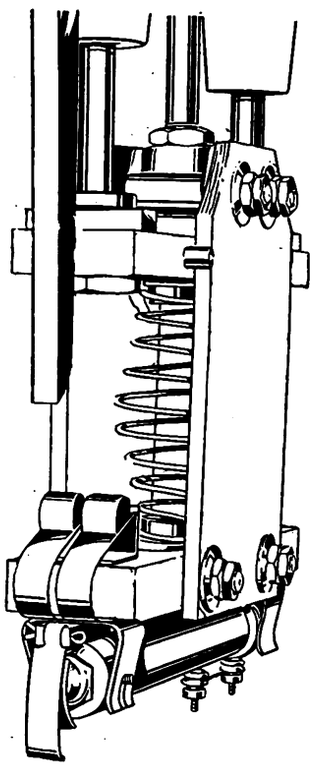

Fig. 4.—Detail View of Fuse and Switch Contacts.

mechanism after the switch has been opened isolates the complete unit. Means are provided to facilitate the lowering of the oil tank for inspection and replacement of fuses; also the complete switch may be removed by the same means to facilitate the making of cable joints and connections, or to enable the complete switch unit to be taken away for inspection.

The Crompton "T.A.P." breaker is considered by its makers to be eminently suitable for use in situations where time limit overload protection is required, such as for transformer or radial feeder control and for consumers' circuits. It is rated at 100 amps., 11,000 volts; can be set to operate at 2½ amps.; and has a high rupturing capacity. Although robust and substantial, its simple design ensures a low manufacturing cost.

Various terminal arrangements are available for indoor and outdoor service, and the breaker can be arranged for pole mounting with an operating lever at the foot of the pole. A pattern has also been standardised to enable the unit to be mounted direct on the h.p. side of a power transformer. The breaker is now in production and additional sizes are being developed for higher and lower voltages, using the general principles described above.

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Financing Hire-Purchase Systems.

It is possible for a firm selling goods on the hire-purchase system to use the system as a means of securing repeat orders and keeping its customers away from its competitors.

(COMMUNICATED).

HIRE-PURCHASE trading has become so general in the British Isles that almost every industry is affected by it in some way, and its effects are far greater than is commonly supposed. For one thing, it is now practically impossible to judge a man's wealth by his possessions. By depositing a few pounds with a furniture dealer, a man can obtain a house full of furniture. By depositing a few hundred pounds with machinery suppliers, a manufacturer can equip his factory with costly machines. In America almost anything that has a few years' life is purchasable by instalments, and the same can almost be said of England. Homes, furniture, motors, electrical and radio apparatus, musical instruments of all kinds, wearing apparel, &c., can all be bought on the hire-purchase plan, while there is also a tremendous amount of instalment business being done in plant and machinery for manufacturing firms and supplying houses up and down the country.

Modern thought has abolished the old notion that it was "hardly respectable" to buy on hire-purchase terms. "Enjoy while you pay" has become the present-day slogan, and the large stores don't forget to drive this point home in their advertisements. It is simply a form of credit, similar, in a way, to that indulged in from time immemorial with regard to tailors' bills and tradesmen's accounts—a habit which is practised by the best society! But it has this great difference—it is an honest contract: the supplier of the plant, the machinery, or the articles in question is not being cheated of his just dues, and the amount of the credit is being reduced periodically.

No Invoices or Statements.

A trader should never send out an invoice or statement in connection with goods sold under a hire-purchase system, because these documents could be used by the purchaser to give the impression that the goods were his. If, therefore, such documents fell into the hands of a receiver in bankruptcy, they would give him valuable evidence of ownership. It is advisable for a complete specification of the articles supplied to form part of a hire-purchase agreement. If a copy of this agreement is handed to the purchaser at the time of sale, this specification will give sufficient information for any books that the purchaser may keep and an invoice will be unnecessary.

The hire-purchase trader should take care to protect his goods out on hire from loss by fire, or any risks that may apply. He will usually obtain one floating policy covering the whole of his stock in the hands of his customers. Every time goods are sent out on hire the amount of the policy will be increased by their value, and every time a hire-purchase is completed the amount of the policy will be reduced by the value of the goods in which the trader is no longer interested.

Form of Agreement.

If a trader is serving customers who are forced to buy on the instalment system, he will be well advised to incorporate in his agreement conditions that will provide for any contingency, and it will generally be found that the purchasers are not in a position to complain of this. When, however, the retailer is serving customers of higher financial standing, who pay by instalment because it is, to them, the most convenient method, he will have to make his hire-purchase agreement simple and reasonable. In such cases, the agreement should have the appearance of an order form rather than a legal document. It should be printed in an attractive style and on good paper, and the conditions should be set out clearly and in simple language.

In selling goods to this class of customer a trader need not provide for every contingency in preparing his hire-purchase agreement. It is a well known fact that the wealthier classes take more care of their goods and chattels than do the poorer classes, and they will assume greater responsibility in connection with articles bought on hire-purchase terms. It will generally be found that a customer in comfortable circumstances can be relied upon to complete a hire-purchase as soon as possible, and will often do so some time before the end of the period of credit allowed.

Financing the Hire-purchase System.

There is no need for the retailer to worry about financing his hire-purchase business, for there is now a large number of financing houses which are established for the sole purpose of advancing money to traders who do hire-purchase business. These financing houses are usually secured by an assignment of all the trader's rights under the hire-purchase agreement, so that the trader's lien on his goods is really passed over to them. In some cases the financing house advances only a proportion of the amount invested in the hire-purchase system and takes no part in the collection of the instalments, but in other cases the financing house buys the trader's interests in the sales outright, at a discount, and collects the instalments itself.

In this present time of difficulty and monetary stringency, living, as we do, in a highly industrialised world, everybody needs credit; even the big 'bus companies and haulage contractors who need more vehicles may not see their way clear to laying down the full cost in ready money. It is to meet all such cases that these instalment and hire-financing companies undertake to provide the necessary cash against risks that are reduced to a minimum by means of insurance against anything that is likely to happen in an uncertain world—such as damage, theft, fire, or default on the part of the hire-purchaser. When once this load has been lifted from the shoulders of the supplier he is free to extend his operations.

A typical example may be seen in the case of a small fried-fish business, in which a man may not be able to produce a lump sum of, say, £160 for a tiled and nickelled three furnace frier, but he is now able to get such a piece of apparatus by instalments, and its very presence in the shop, whilst it is being paid for, is a sales help.

In the same way a business which calls for distribution is able to get motor vans or lorries, and so widen the circle of its influence while the increased business is paying for the cause of it. Holiday-makers enjoy tours in charabancs that are still being paid for by instalments, just as the private owner pays every month a part of the purchase price of his high-powered car or his bicycle.

Developing a Market.

The disquiet that is expressed in some quarters concerning the growth of instalment purchase is evidence that many are ignorant of these insurance schemes, which are enormously increasing the possibilities of the

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use of capital. In many cases sales managers are crying that, if only it were not for the fact that so much of their financial resources was tied up, they could expand their trade, lower their overhead charges, and reduce prices. From the sales department's point of view, the hire-purchase system develops a consistent market for all kinds of commodities that is far above the ordinary cash-down sales system, and, from the purchaser's point of view, it enables him to enjoy the comforts and conveniences of life, for which he would otherwise have to save for a long period.

Here in England the instalment-purchase business is spreading, and a firm, to be up-to-date, should be prepared to accept business on these lines. But, in order to free itself from the restrictive effect that such business would entail, its principals should get into touch with one of the financial houses that specialise in dealing with this form of selling.

Electricity for the Home.

Notes on the progress made in domestic electrification by a municipal electricity supply undertaking serving a middle-class residential district.

Developments at Barnes.

IN contrast with the Hammersmith undertaking, to which we referred last week, the domestic load at Barnes is really "there for the asking," no doubt because the district is almost wholly a middle-class one. The engineer and manager, Mr. C. S. Davidson, M.I.E.E., and his staff are to be congratulated on the manner in which they have grasped the opportunity of domestic business. The business is obtained not so much by propaganda as by low tariffs. There is an all-in tariff in vogue of 7½ per cent. of the ratable value of the premises, plus 1d. per unit for energy consumed from October 1st to March 31st, and ½d. per unit from April 1st to September 30th. Hot-water storage is catered for at 0.33d. per unit, the supply being time-switch controlled to limit it to the night period during the winter months. An interesting article dealing with the water-heating question, from the pen of Mr. Davidson, appeared in our issue of August 16th, p. 273. Existing hot-water tanks in houses equipped for water heating by coal or coke are heat insulated by a suitable mattress, and the tanks are equipped with immersion heaters. There are at present about 50 consumers at Barnes taking supplies for water heating in this manner. The attractiveness of this scheme to the consumer will be appreciated when it is realised that for an expenditure of 3d. per day 20 gal. of water can be obtained at a temperature of 180 deg. F.

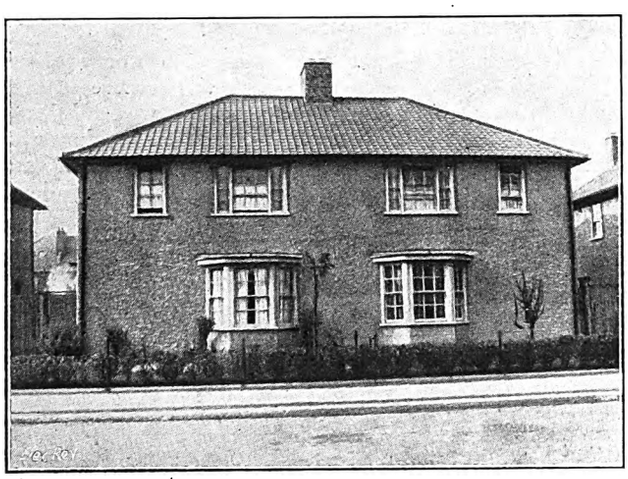

Fig. 1.—Exterior of "All-Electric" House.

Out of about 10,000 houses in the Barnes supply area, 8,000 are connected to the undertaking's mains. There are 400 cookers out on hire, and many new consumers have up to 15 kW of electrical domestic apparatus installed. The majority of consumers have installed loadings of 5 kW. There is also a number of workmen's cottages in the area, and the occupants generally are keen to take advantage of the cheap supply afforded by their low assessments. On a large estate of the London County Council in the area, comprising some 650 houses, 57 cottages are wired as all-electric, with the exception of one coal fire in the kitchen. The undertaking is making the "all-electric" proposition a particularly attractive one for these consumers. They are all on the ratable tariff, and the electrical equipment, which includes a cooker, wash boiler, 2-kW radiator, bowl fire, iron and an electric kettle, is hired to each consumer, all for 10s. per quarter. A view in the interior of one of these houses is shown in fig. 2, and one of the exterior in fig. 1. The success of the scheme is indicated by the fact that occupants of the other part of the estate are eager to move to the "all-electric" portion. The maximum consumption for one consumer in the houses was last year 6,480 units, the maximum payment being £25 6s. 7d. The average revenue obtained from the houses was £9 14s. 7d., and the average price obtained per unit was 0.99d., exclusive of hire charges, and 1.25d., inclusive of hire charges. The total energy sold to these houses last year was 106,228 units, 54,812 units being consumed during the two summer quarters.

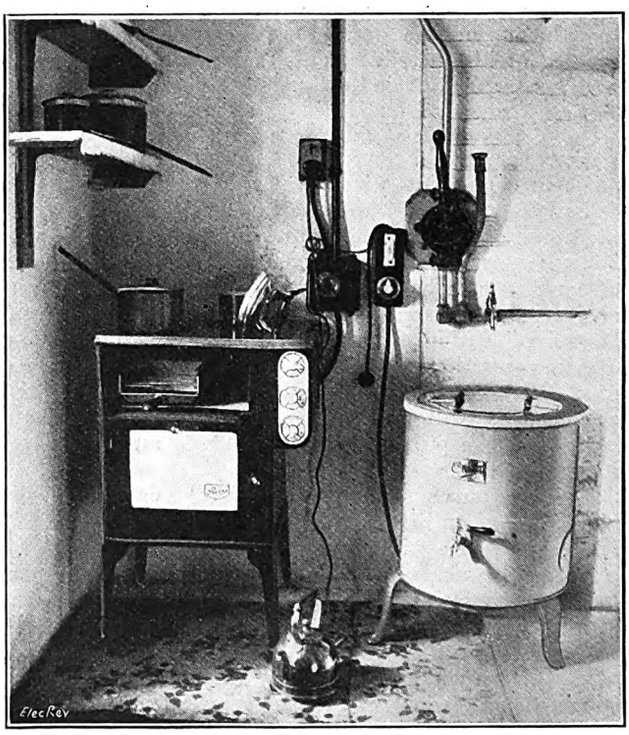

Fig. 2.—View in "All-Electric" House, showing Cooker and Wash-boiler.

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A progressive builder in the area has been encouraged by the attractive terms offered by the Department to erect 150 houses, valued at about £1,250 each, all being wired on the "all-electric" principle, except for one coal-fire. An electric cooker is supplied with every house, and most of the purchasers have had installed, in addition, two 3-kW fires and a wash boiler, besides smaller apparatus. Considerable use is made at Barnes of the publication of the Electrical Development Association's entitled "20th Century Cookery," edited by Mrs. A. Mole, M.C.A. This book has proved popular among consumers.

The hiring rates for cookers at Barnes vary from 3s. 6d. per quarter to 12s. 6d., and with every cooker is supplied an electric kettle. The undertaking does its own repairs and reconditioning, and the maintenance costs as the result have proved very low indeed.

On 285 cookers for last year, the total handling and maintenance costs amounted to about £100. Among a variety of types of cookers which are being hired out by the undertaking, the new No. 1284 "Hotpoint" cooker has proved popular. This cooker, fig. 3, which is among a range of cookers introduced by the makers specially for hiring schemes, is suitable for seven to ten persons. The hob carries two 8-in. square and one 6¼ in. diameter enclosed-type boiling plates, a separate grill, with a door to the grill chambers. The oven is of the one-piece removable type, the corners being rounded for ease in cleaning, the sides of which are fitted with round-wire shelf runners. The boiling plates, grill, and oven are arranged for three-heat control. The loadings are: two square boiling plates, 1,800 W each; circular plate, 1,000 W; grill, 1,750 W; and oven, 3,000 W. The hob is vitreous enamelled mottle grey, as are also the removable oven and the inside door pad. A heat indicator is fitted on the oven door, and the doors of the oven and grill chamber have vitreous enamelled white panels. The switch indicating plate is also white vitreous enamelled with black indicating letters.

The dimensions are: hob, 28¼ in. wide by 22½ in. deep; oven, 16 in. wide by 16 in. deep by 18 in. high (available cooking space); height to hob, 37¼ in.; grill

Fig. 3.—"Hotpoint" Cooker used at Barnes.

space, 10 in. wide by 7 in. deep; and grill chamber and warming cupboard, 17 in. wide by 21 in. deep by 6 in. high. A feature of the revised model of this cooker is that the cut-away portion of the hob is now dispensed with, so that the hob is complete in one piece, and is hinged at the back; it can be easily raised for inspection of the internal wiring, fuses, &c., without the removal of the back skirting and pot rack.

Fig. 4 shows the "Bastian" 1929 water heater, which is now being supplied to the Barnes undertaking, where immersion heaters in existing tanks are not practical. The following are the principal features of this apparatus: thermostatic control; efficient cork lagging; towels and linen can be aired on the lid; immersed heating elements; wall brackets and outlet in base in type "W"; ball valve arranged for either side of heater; nickel-plated fittings; minimum furring due to low-temperature heating design; and easy maintenance. The

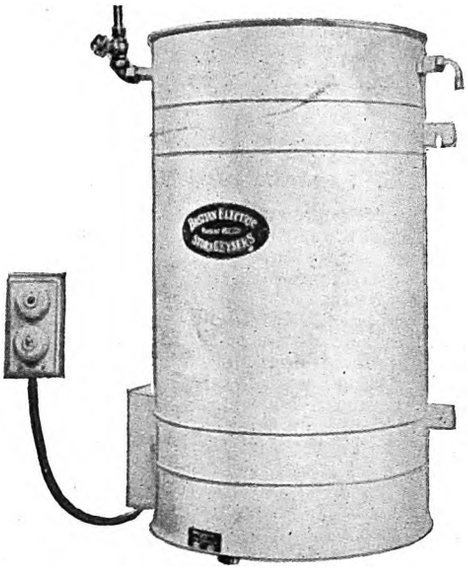

Fig. 4.—"Bastian" Water Heater; 1929 Model.

heating tube on which the sediment settles can be easily unscrewed and cleaned. The loose lid enables easy work and inspection.

The appliances referred to in the foregoing notes are made by, respectively, the Hotpoint Electric Appliance Co., Ltd., 24, Newman Street, Oxford Street, London, W.1, and the Bastian Meter Co., Ltd., Farnham Road, Trading Estate, Slough, Bucks.

Installations in American Houses.

A nation-wide survey on behalf of the Society for Electrical Development in the United States is announced to have been completed. The survey, conducted in 3,203 typical homes in 23 communities, situated in 17 of the United States and also in the Province of Ontario, is stated to be a preliminary to a national campaign to increase the use of electricity in the home. The homes visited were selected to reflect varying buying power, and included all types of residences with from four to fifteen rooms. The objects of the survey were to determine the adequacy with which typical American homes are wired, as gauged by the minimum standard of the Society for Electrical Development; to find the number and nature of electrical appliances in the typical household; to study "consumer interest" and appreciation of the value of electricity; and to determine ways to develop a large market for electricity and electrical apparatus in American homes.

The dining room was found to be nearest to the specifications in the greatest number of cases, the best bedroom meeting minimum requirements in only 43 per cent. of the homes. Except for the living room, nearly half the rooms were found to have no convenience outlets. Most of the homes were reported to be fairly well equipped with ceiling fixtures and wall brackets, but the lack of switches is said to have been marked.

Free Maintenance.

Faith in the electric range is apparent in the Tasmanian Hydro-Electric Department's advertising campaign, which features easy terms of purchase, and free maintenance of ranges for three years!—*Australian Electrical Times.*

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Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

The G.E.C. and the Ideal Home Exhibition.

One of the outstanding attractions of the 1930 *Daily Mail* Ideal Home Exhibition, which is to be held at Olympia from March 24th to April 17th, will be a "Pavilion of Light" arranged by the General Electric Co., Ltd., in connection with which the company and the *Daily Mail* have organised a competition in which £1,000 will be offered in prizes. The Pavilion will include a suite of six rooms. It is the lighting, decorating and furnishing and equipment of these rooms which will be the basis of the competition. The lounge, dining-room, bedroom, and nursery will be the subjects of one section of the competition for architects and decorative artists, while the kitchen and the bathroom will be the basis of another for electrical contractors, with the object of demonstrating the ideal use and security of electrical equipment in these rooms. When the results of the competition have been decided by a distinguished committee of assessors, the winning designs will be incorporated in the "Pavilion of Light." Full particulars and rules of the competition will be announced at an early date.

Dutch Radio Exports.

The exports of wireless sets and accessories from Holland continue to increase. In August the quantity amounted to 999 gross tons as compared with 327 tons in the corresponding month of last year, the value being 7,123,000 fl. The exports to England in August were considerably augmented, and represented 346 tons out of the total mentioned. For the eight months ended with August the exports are given at 6,391 tons, against 2,218 tons in the corresponding period of last year, the value rising to 51,989,000 fl. from 12,402,000 fl.

The German Cable Industry.

Business in the German cable industry is not altogether satisfactory, says the *Deutsche Bergwerks Zeitung*, and, in view of the approach of winter, will probably grow worse. It is said that various concerns already intend to restrict production. Prices have remained comparatively steady of late after they had been advancing slightly since the beginning of the year owing to the higher production costs. The trend of the copper and lead quotations naturally has a very marked effect on the prices for cable products. At the moment buyers are very reserved; the public authorities appear to have cut down their expenditure recently in many ways. Export business has increased rather appreciably during the last few years. In 1927, 42,000 tons of cables, valued at 40,000,000 marks, were shipped abroad, rising in 1928 to 49,000 tons, valued at 47,000,000 marks. From January to the end of July this year 33,500 tons, valued at 35,000,000 marks, had already been exported.—*Reuter's Trade Service* (Düsseldorf).

A Central Electricity Board Contract.

The Tees-side Bridge and Engineering Works, Ltd., Middlesbrough, has received an order from the Central Electricity Board for steel structural work in connection with the Mid-East England Electricity Scheme. About six thousand tons of steel are involved in the contract, which will take two years to complete.

The De-Rating Scheme.

The provisions by which manufacturers will be relieved of three-quarters of their rates came into operation on Tuesday last. It is anticipated that the relief will give a considerable impetus to trade, particularly in the iron and coal industries. *The Times*, in a recent review of the probable results, mentioned that in Coventry the assistance afforded by the scheme would be considerably offset by the increased cost of power. The assessment of the electricity undertaking had been so substantially increased that it had been necessary to add 13 per cent. to electricity charges.

Unemployment.

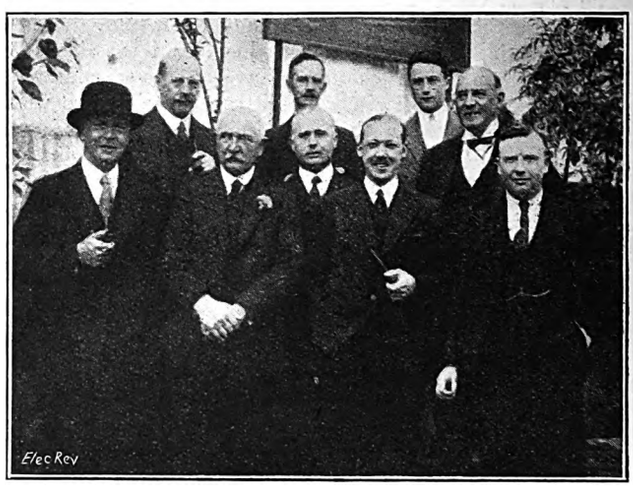
The number of registered unemployed persons on September 16th totalled 1,147,500, a decrease of 2,192 since September 9th, at which date the number was 1,149,692. The corresponding figure for September 17th, 1928, was 1,293,659.

A Supply Company's Propaganda.

We have received from the West Gloucestershire Power Co., Ltd., a booklet entitled "Electricity in the Home," in which particulars are given of a home fully equipped with electrical domestic appliances, with some useful hints regarding the types of fittings for various rooms. The company's charges for electric service are explained, and information is given to intending users as to where and how a supply can be obtained, with notes on the choice of contractor. Examples of the cost of electricity in the home are also given, and the amount of electricity consumed in a given time by various appliances. Illustrations of the "all-electric" demonstration house at Ryeford are included.

Wholesalers at the Newcastle Exhibition.

We reproduce herewith a photograph of members of the Council of the Electrical Wholesalers' Federation who visited the North-East Coast Exhibition, Newcastle, at the invitation



E.W.F. Councillors at the Newcastle Exhibition.

of the North-East Coast Section of the E.W.F., on September 5th. Included in the photograph are the president, Mr. J. Wilson, of Middlesbrough; the secretary, Mr. J. W. McKay; and the chairman, Mr. H. Barkes.

Electrical Regulations in New Zealand.

The Department of Overseas Trade has received from the office of the Trade Commissioner at Wellington reprints of (1) the schedule of amendments of the Electrical Supply Regulations, 1927; (2) the schedule of amendments of the Electrical Wiring Regulations, 1927. These reprints are available for loan to British firms interested on application to the Department, 35, Old Queen Street, London, S.W.1. Reference B5701 should be quoted.

New Municipal Showrooms.

The members of the Worcester City Council paid an official visit last week to the Corporation's new electrical showrooms in Queen Street. The rooms have been designed by the borough electrical engineer, and are of a thoroughly up-to-date character. The display shows the latest improvements in lighting and electrical domestic equipment for cooking, heating, &c.

New G.E.C. Lamp Price Indicator.

The General Electric Co., Ltd. has issued a revised edition of its "Osram" automobile lamp price indicator. This takes account of the recent price reductions. The indicator can either be hung on a wall or stood on the counter. In shape it is an enlarged representation of an "Osram" headlight lamp.

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The E.D.A. October Programme.

The accompanying illustration is reproduced from the October supplementary programme of the British Electrical Development Association. It depicts the suggested window display for the month, the necessary materials (apart from the actual appliances) being obtainable from the Association. The subject is, as usual, appropriate to the month and with the suggested colour lighting scheme the display should be very effective. Three new posters have been produced, two of them —"A Warm Welcome" and "Fire Without Smoke" attractively advertise electric heating. In the latter, attention is specially drawn to the "outlet." A switch-plug is also fairly prominent in the third poster, "Winter Nights are Cheerful Nights," which deals with electric lighting and shows two or three modern fittings in a comfortable setting. The programme also contains a list of the appropriate E.D.A. publications, several of which deal with after-hours shop window lighting.

Attention is drawn to the E.D.A. Electric Homes (Outlet) Campaign and to the 1929-30 Sales Conferences. The first of these takes place on October 18th. Sir Andrew Duncan, chairman of the Central Electricity Board, will preside, and Mrs. Gladys Burlton, B.A., will read a paper on "Personal Salesmanship in the Electrical Industry." The second is on November 15th, when the chairman will be Sir John R. Brooke, C.B. (Electricity Commissioner), and Mr. E. E. Sharpe will read a paper entitled "Selling Time Switches." On December 20th there will be a display of kinematograph films. The 1930 part of the programme is as follows:—January 17th, "Domestic Hot Water," by Mr. C. H. Smith (chairman, Sir Hugo Hirst,

The E.D.A. Window Display for October.

Bt.); February 21st, "The Electrical Industry and the Architect," by Mr. C. H. Flower (chairman, Mr. Ll. B. Atkinson); and March 21st, subject to be decided by the Conference. The meetings will be held at the Royal Society of Arts, W.C.2. On the back page of the programme are some very useful and interesting "Notes by the Director." These call attention to the benefits of electric heating and the necessity of adequate wiring.

The Association is still following up its 1928-29 Factory-Lighting Campaign. A booklet has been published (E.D.A. 804), in which some results of the Campaign are mentioned. There is a number of illustrations showing the illumination of some works and shops before and after the Campaign had made its effects felt. The fact that good lighting pays is again stressed in the booklet, and manufacturers are asked to look at their electric lighting installations with a critical eye, several points for attention being set out.

Indian Electrical Imports.

The *Board of Trade Journal* states that the imports of electrical machinery into India during the June quarter of this year were valued at Rs. 61½ lakhs, against Rs. 54¼ lakhs in the corresponding period of 1928. The share of the United Kingdom rose from Rs. 43 to 45¼ lakhs, and that of Germany from Rs. 2 to 4 lakhs. Shipments from the United States, however, declined from Rs. 6¾ to 5¾ lakhs.

The imports of electrical instruments, apparatus and parts again advanced, from Rs. 79 lakhs to Rs. 98¾ lakhs, of which the British share rose from Rs. 49 lakhs to Rs. 57½ lakhs. Shipments from the United States advanced from Rs. 9¼ lakhs to Rs. 14 lakhs, and from Germany from Rs. 8½ lakhs to Rs. 12¼ lakhs. There were also slightly larger shipments from Holland, Rs. 5½ lakhs; Italy, Rs. 4½ lakhs; and Japan, Rs. 1¾ lakhs. Analysing the total, it is found that imports of electric fans and parts thereof rose from Rs. 9¾ lakhs to Rs. 14 lakhs, of which the British share rose to Rs. 6½ lakhs and the Italian share to Rs. 4 lakhs. The share of the United States was Rs. 1¼ lakhs. Imports of electric wires and cables advanced from Rs. 23½ lakhs to Rs. 31½ lakhs, of which the British share was Rs. 26 lakhs. Shipments from Germany amounted to Rs. 2 lakhs, and from Holland Rs. 1½ lakhs. The value of accumulators imported rose slightly to Rs. 3¾ lakhs, of which the British share was Rs. 2¾ lakhs. Imports of electric lighting accessories and fittings (including switches) declined from Rs. 4¾ lakhs to Rs. 4 lakhs, of which the British share was Rs. 2¼ lakhs. Meters to the value of Rs. 3 lakhs were imported, of which the British share was Rs. 2½ lakhs. Imports of electrical goods and apparatus not enumerated increased from Rs. 11½ lakhs to Rs. 14 lakhs, of which the British share was Rs. 9½ lakhs, that of Germany Rs. 1½ lakhs, and of the United States Rs. 2 lakhs.

There was a sharp decline in imports of radio apparatus from Rs. 3½ lakhs to Rs. 1½ lakhs. and the British share fell from Rs. 2¼ lakhs to Rs. 1 lakh. Imports from Germany also fell from Rs. 55,000 to Rs. 19,000, and from the United States from Rs. 34,000 to Rs. 19,000. Imports from Holland rose from Rs. 17,000 to Rs. 26,000.

The E.D.A. Outlet Campaign.

A good audience gathered together at the Manchester Demonstration Bureau last week for the first Conference of the E.D.A. Electric Homes Campaign. Mr. H. C. Lamb, of the Manchester Corporation Electricity Department, took the chair, and emphasised the importance and value of the campaign in endeavouring to put an end to the construction of houses without adequate facilities for electrical appliances. Lt.-Col. Vignoles, the director of E.D.A., outlined the objects and methods of carrying out the campaign, and referred to its appeal to the general public, the housewife, and the architect and builder. He also expressed the opinion that the campaign was likely to become part of the permanent work of E.D.A. An interesting discussion followed, in which every speaker approved of the campaign in the main, and several offered valuable suggestions. Mr. Romero, of Salford, said that the word "plug-point," mentioned by Col. Vignoles, was an excellent solution to the name problem, as it combined the idea of position with plug. Mr. Hutchinson, of the Farnworth Electricity Supply, said that the campaign ought to be extended to embrace old houses, and not be content with attracting the attention of new householders. In his area they were constantly extending the supply to old houses. Mr. Hazel, of the Liverpool Corporation, said that there was not much necessity to appeal to the architect and builder, as he found that they mostly knew all about correct wiring. It was the general public who wanted educating to the idea of more plugs. Mr. Simpson, of the Preston Electricity Department, remarked that in his area the average consumption per house was as high as 1,460 kWh a year. He suggested that "service-point" would be a good alternative to "outlet." Replying, Colonel Vignoles said that he was interested in Mr. Simpson's statement with regard to the high consumption in Preston, and this confirmed his view that the average household consumption in this country was higher than that in the United States. He would like other supply authorities to send along their figures, as they were very interesting and difficult to obtain.

A meeting was held on September 25th at the Birmingham Chamber of Commerce to inaugurate the new campaign to promote the wider use of electricity for domestic purposes in the South Midlands, Mr. R. A. Chattock presiding. There were present many members of the Birmingham branch of the Electrical Association of Women. Lieut.-Col. W. A. Vignoles said the object of the campaign was to encourage the demand for adequate wiring in homes. Only a small proportion of houses were at present adequately wired, a state of affairs for which there was now little excuse, since roughly 60 per cent. of the population lived in areas where electricity was supplied at about 1d. per kWh for purposes other than lighting. As the demand increased the price would be still further reduced. In the modern home adequate arrangements should be made for the use of electricity in every room.

Wages in the Electric Cable-making Industry.

The Joint Industrial Council for the Electrical Cable-Making Industry informs us that, although there would ordinarily be no cost-of-living alteration in wages on the third pay-day in October, at the request of the trades unions for an increase in wages, it has been agreed to advance time-workers' wages by the equivalent of one step up in the sliding scale. Therefore the rate of wages will be equivalent to the scale for a cost-of-living index of 67½-75.

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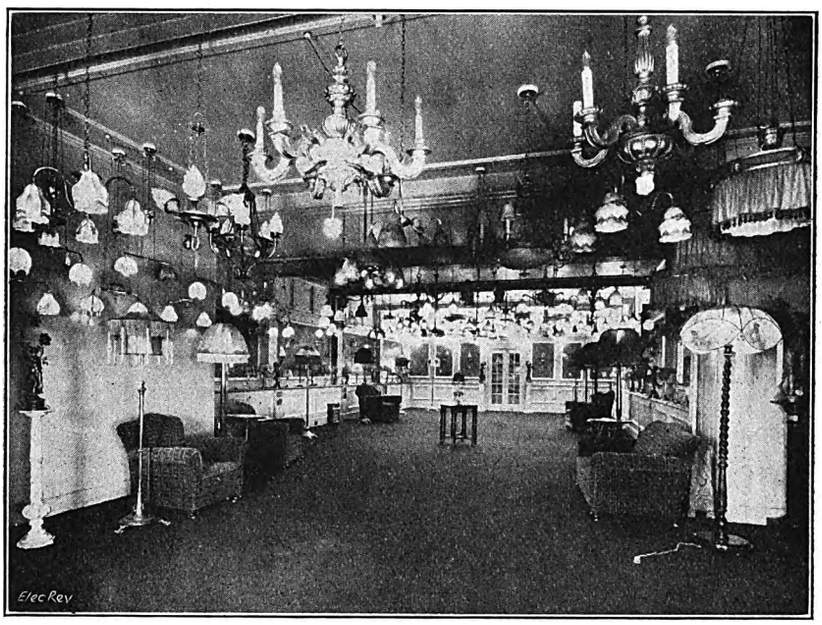
The A.E.G. in Central America.

The Allgemeine Elektricitäts Gesellschaft, which recently constructed the National Electric Light Co.'s plant in Panama, has now, according to a New York message, acquired control of the company by share purchase. This concern is in competition with the Panama Power & Light Co., which is American. This is not the first enterprise of the A.E.G. in this connection. Recently it acquired a power station in the Costa Rican capital, San Jose, which was likewise run in competition with an American concern. In this case, however, the rivalry was eventually ended by the union of the two concerns under joint management.—*Financial News.*

London Lighting Fittings Showrooms.

Lighting Trades, Ltd., which incorporates the businesses of the Welsbach Lighting Co., Ltd., and J. & W. B. Smith, Ltd., has arranged excellent showrooms at its headquarters, Oriel House, Farringdon Street, E.C.4, in which the best fittings of the two older concerns are displayed. Although the collection is an extensive and representative one, its effect is not marred by overcrowding, as is so often the case. The designs which are to be seen are adapted to all tastes and pockets, ranging from costly alabaster and art-metal pendants to inexpensive glass shades. A special feature is made of "Moonmist" pressed glassware, which is shown in a multitude of forms and designs. In addition to the lighting fittings, the company has on view examples of its electric fires and small domestic appliances. A view of the main showroom is reproduced herewith.



The Showrooms of Lighting Trades, Ltd.

Local Exhibitions.

Glasgow.—Electricity occupied a prominent place in the Corporation Housing and Health Exhibition, which was opened in the Kelvin Hall on September 25th by Sir James Barrie. Glasgow Corporation Electricity Department has four stands at which demonstrations are given of electric cookers, fires, and water heaters. There is also a modern electric kitchen, showing time- and labour-saving electrical devices. Another attractive display is that arranged by the Clyde Valley Electrical Power Co. In addition to electrical appliances for cooking, washing, cleaning, lighting and heating, there is a well-appointed kitchen, lounge, and fire showroom. Among the other electrical exhibitors are the following:—Entwistle & Kenyon, Ltd.; the Carron Company; Ross's Dairies, Ltd.; Young, Osmond & Young, Ltd.; Singer Sewing Machine Co.; the British Vacuum Cleaner and Engineering Co.; Tellus Electric Cleaner Co.; Allied Ironfounders, Ltd.; W. J. Hannah & Co.; the British Horo-Electric, Ltd.; Triplex Foundry, Ltd.; Smith & Wellstood, Ltd.; Dominion Machinery Co., Ltd.; the Edison Swan Electric Co., Ltd.; Archibald Low & Sons, Ltd.; Hoover, Ltd.; and Electrolux, Ltd. The apparatus demonstrated on the stands of the Corporation and the Clyde Valley Company includes products manufactured by the Hotpoint Electric Appliance Co., Ltd., the General Electric Co., Ltd., Belling & Co., Berry's Electric (1928), Ltd., and the Credenda Conduits Co., Ltd.

Brighton.—An electrical exhibition, organised jointly by the Brighton Corporation Electricity Department and the British Electrical Development Association, will be officially opened by the Mayor (Alderman H. J. Galliers) on October 10th. It will remain open until October 19th. The exhibition is being held in the Corn Exchange and Dome Buildings, and the former is divided into three main sections, devoted, respectively, to water heating, cooking and heavy appliances, and a fully-equipped hotel and restaurant kitchen. In the water-heating section there will be a series of rooms equipped with baths and toilet basins, with the various makers' water-heating apparatus in operation. The exhibit will be the most comprehensive water-heating display yet seen in this country. The food prepared and cooked in the hotel and restaurant section will be served at the exhibition restaurant. The exhibits in the Dome will comprise fittings, fires, refrigerators, and miscellaneous appliances. A series of electrical demonstration tableaux will be staged by the E.D.A. on the E.L.M.A. stand. Recitals will be given on the Dome organ during the exhibition. Admission will be by ticket, price 6d.

Recent Contracts.

Messrs. Hick, Hargreaves & Co., Ltd. have secured a contract for the complete power equipment of a large cotton mill being built at Heera, in the state of Gwalior, Central India. The mill will have 35,000 spindles and 1,000 looms, with an ultimate capacity for 55,000 spindles and 1,500 looms. The power drive will be a combination of rope and electric transmission, and will be supplied by two Hick, Hargreaves high-speed impulse turbines

Messrs. Boving & Co., Ltd., have received the contract for the new 60,000-b.h.p. water turbine plant ordered by the Hidroelectrica Iberica, Spain. The head is 345 metres, and the speed of each of the two units is 428 r.p.m., the turbines being of the Pelton type. This is an extension of the existing Rio Cinca plant of 61,500 h.p., consisting of three units, which were also supplied by Boving & Co. The new Peltons will be equipped with stainless steel buckets. It is claimed that the new machines are amongst the most powerful single-wheel units in the world. Boving and Co. have also received an order for two vertical shaft Francis-type turbines for the New Zealand Government's development at Waitaki. Each turbine will have an output of 23,000 b.h.p. at 125 r.p.m. on a head of 70 ft. The wheels of these turbines will have an overall diameter of 13 ft. 6 in., and the company states that they will thus be the largest ever built in Great Britain. The company has recently shipped to Palestine the two turbines for the first stage of the Jordan development undertaken by Mr. Rutenberg, and these units will have an output of 8,500 h.p. at 250 r.p.m. on an 88 ft. head. Stainless steel has been used for the wheels, and the company is supplying all the gates, stop logs and their lifting equipment as well as the pipelines for this scheme. Messrs. Boving & Co. also have a large number of other important orders in hand for all parts of the world.

Asea Electric, Ltd., Manchester, has received an order for the complete electrical equipment of the Dicken Green Mill, Rochdale, including a slow-speed alternator and between 50 and 60 motors.

The Westinghouse Brake & Saxby Signal Co., Ltd., in competition with German firms, has secured the contract for the complete signalling system for the new central railway station at Johannesburg. The system will be "all-electric" with power-operated points and colour-light signals.

Conditions in Estonia.

Estonia is one of the smaller Baltic States, having a population of about 1,120,000. It is accordingly not likely to be an extensive market for British electrical products. A report on conditions in the Republic has been transmitted to the Department of Overseas Trade by Mr. C. B. Jerram, British Consul at Tallin (Stationery Office, 9d. net). In a commercial summary prefacing this report it is shown that while Great Britain is Estonia's most important customer, it is only third in the import list, Germany and the United States being well ahead. Mr. Jerram says that British goods are "extraordinarily popular" in Estonia and are often purchased at higher prices than those offered by competitors. Foreign competition has to be seriously countered, credit being one direction in which Great Britain lags behind competing countries. Electrical machinery and apparatus is not specially mentioned in the report, but it is shown that non-agricultural machines, motors and vehicles were fifth in the import list in 1928, representing a value of 11,731,000 kr. of a total of 131,370,000 kr. (£1=19 kr. approx.).

Later in the report it is stated that interest is aroused from time to time, both in Estonia and abroad, in the scheme for the exploitation on a large scale of the Narva rapids. There appears at the moment to be a definite recrudescence of interest in this matter, and it is reported that a foreign firm is at present negotiating with a view to the construction of a power station and a large pulp mill. It appears that without the pulp mill there would hardly be sufficient market for the power in the near future to warrant the construction of the station. There would seem to be several difficulties to be overcome connected with such considerations as (*a*) the supply of timber for pulp, which would have to be obtained from the

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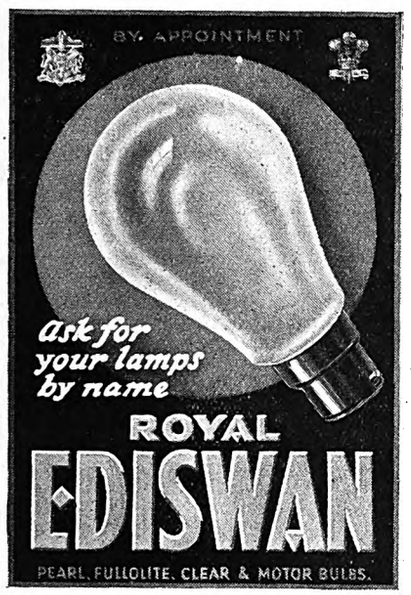
Soviet Union, (*b*) a clause in the Estonian-Soviet Peace Treaty of 1920 providing that the Soviet Union should have preferential rights to obtain electric power from the Narva rapids, and (*c*) the claims of the factories situated at the rapids, which already generate power therefrom. It is at present impossible to say whether the negotiations now proceeding will lead to any immediate result.

The *Board of Trade Journal* states that during July last Estonia imported "electric machines, apparatus, and implements" valued at 160,100 kr. (£8,800), and exported similar goods to the value of 37,300 kr. (£2,000).

The "Ediswan" Lamp Campaign.

We have received from the Edison Swan Electric Co., Ltd., a broadsheet setting forth details of its winter lamp campaign,



A New Electric Lamp Poster.

together with samples of the booklets, &c., which are being distributed. In common with other lamp makers, the Ediswan Company concentrates attention on its Pearl lamps, and the principal feature of the campaign is a simple but colourful poster design depicting one of these lamps (see accompanying figure). The catalogues are attractively produced and contain full details and prices. The broadsheet contains a list of towns in which the "Royal Ediswan" poster will be displayed, and it illustrates illuminated signs and window displays which are available for retailers' use. The leading device for window displays is an animated centre piece produced in delightful colours.

New Argentine Company.

Particulars of the Ferro-Carril Central de Buenos Aires, Limitada, were filed on September 19th. The authorised capital is $25,000,000, of which, to June 30th, 1928, $22,565,000 (£1,969,960) had been issued. The company was incorporated in the Argentine Republic, to continue the construction and working of railways for the transport of merchandise and passengers with steam or electric traction already granted or applied for by Lacroze Hermanos y Compania. The registered office is in Buenos Aires, and the British address is at 4, Moorgate, E.C.2, where Mr. M. A. Edwards is authorised to accept service of process and notices on behalf of the company. The directors are: T. Lacroze, L. J. Rocca, Ana B. de Lacroze, and F. Lacroze, all of Buenos Aires, and directors of the Compania Tramways Lacroze de Buenos Aires, Ltda., and Cia de Luz y Fuerza Lacroze de Buenos Aires, Ltda.

Miners' Safety Lamps.

The Secretary for Mines has made an Order under Section 33 of the Coal Mines Act, 1911, approving the Ringrose miners' lamp for use in all mines to which the Act applies, subject to certain conditions set out in the Order.

Wages in the Electrical Contracting Industry.

The variation in the cost of living since the last alteration of wages in the electrical contracting industry justifies a reduction of ½d. per hour for all grades. The rates, which will, therefore, come into operation on the second pay-day in October, for the period covered by that pay-day, will be as follows:—Grade A, 1s. 10½d.; Grade B, 1s. 7½d.; Grade C, 1s. 5½d.; and Grade D, 1s. 4½d. The Grade A rate includes the increase of 5 per cent. which came into operation in May last, and remains in force up to and including the last pay-day in October. The new rates for Grades B, C and D will remain current up to and including the period covered by the first pay-day in February, 1930.

Trade Announcements.

Mr. G. Ellam, wholesale electrical supplier, has removed to 49, Gartside Street, Bridge Street, Manchester. The telephone number (Central 8213) is unaltered.

Messrs. Hardman & Co., Ltd., The Baum, Rochdale, Lancs., have been appointed by Abbey Cables, Ltd., as its sole agents for Lancashire, and will carry stocks at 9-13, Miller Street, Manchester. (Telephone: Blackfriars 1060.)

Messrs. Haslam & Stretton, Ltd., 53, 54 & 55, Tredegar Street, Cardiff, have been appointed by the Credenda Conduits Co., Ltd., as agents for the South Wales (Cardiff) area.

Messrs. Norman Hope & Partners, 61, Wind Street, Swansea, have been appointed by Messrs. James Gordon and Co., Ltd., as their representatives in South Wales.

The Lisenin Wireless Co., has removed to 5, Central Buildings, High Street, Slough. (Telephone: Slough 652; telegrams: "Posgrip," Slough).

The business of C. B. King (Magnetos), Ltd., has been amalgamated with that of the London Magneto Repairing & Winding Co., Ltd., and all communications should be addressed to 78, Hampstead Road, Euston, N.W.1. (Telephone Nos.: Museum 1033, 1158 and 1159.) Mr. C. E. Walker will still be associated with the business.

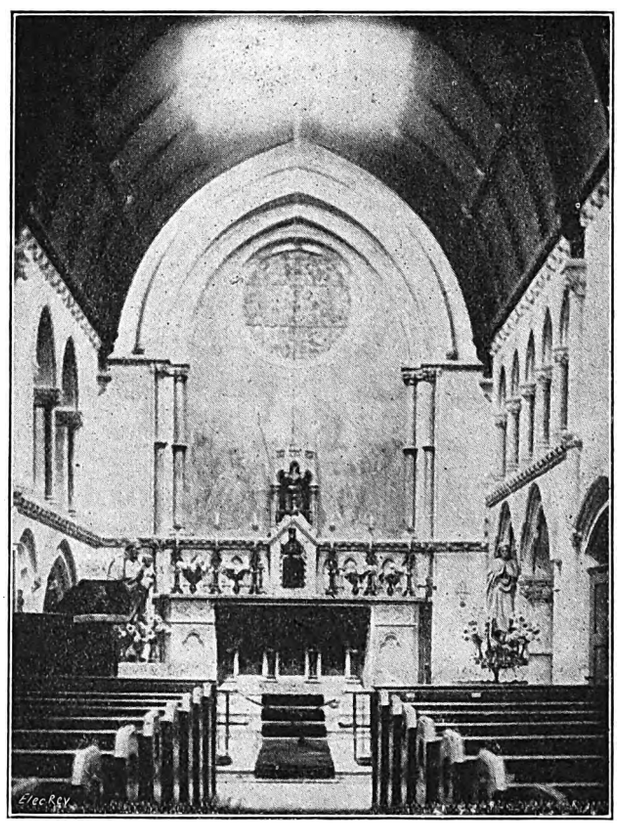
Mr. A. R. Munday, 190, West Regent Street, Glasgow, has been appointed Scottish agent for the wood electrical fittings of Woodfyt Sales, Ltd.

The Midland Electric Manufacturing Co., Ltd., has erected and equipped a new extension to its works. The new department will be entirely separate from the main works, and will be known as the "Specials and Service Department." It is intended to deal with the erection of unit type control panels, variations of M.E.M. gear to suit special requirements, &c.

Messrs. E. R. Morton, Ltd., have removed to 22, Bartlett's Buildings, Holborn Circus, E.C.4. (Telephone: Central 8867; telegrams: "Morelect, Fleet, London."

A Novel Church Lighting Scheme.

A novel and effective church lighting scheme has recently been completed at the Roman Catholic Church, Lyndhurst, by the installation department of the West Hampshire Electricity Company, Ltd. Suspended fittings are not employed. The lamps are placed between the arched ceiling and the true



The Lighting of Lyndhurst R.C. Church.

roof in Metro-Vick reflector fittings, and the only visible evidence of an electrical installation is provided by the corrugated fronts of the reflector fittings, which lie flush on the surface of the ceiling. The lighting is remarkably soft and free from shadow, as will be seen from the accompanying photograph, and the scheme has attracted considerable local interest.

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Book Notices.

"*Elektrotechnická Rocenka, E.S.C.*, 1929" (Year Book of the Czechoslovak Electrical Association, 1929). Pp. 296; illustrated. Prague: Elektrotechnicky svaz Ceskoslovensky. Price, 200 Czech. crowns.—The present Year Book is the fourth volume published and commemorates the tenth anniversary of the Czechoslovak Republic and the E.S.C., by describing the evolution of and work performed by the E.S.C. during its existence. When founded its membership amounted to 400, which number has increased to 2,700. The Association includes members of power companies, manufacturers, and electrical engineers. The general section of the publication contains diagrams pertaining to the economic situation, maps and reviews of foreign trade, prices of metals, machines and apparatus. It also contains a list of granted patents and trade marks, and statistics covering the Czechoslovak electrical industry. The system of electrification is covered by three articles. Detailed statistics show that of the total of 457 electric power stations, 311 are the property of power companies, and 146 are operated by manufacturers. The former generated in 1927 719,000,000 kWh with an installed capacity of 396,700 kW. The total energy generated in Czechoslovakia in 1927 reached 1,700 million kWh, which gives an average of 125 kWh *per capita*. This is an increase of 125 per cent. as compared with 1926. There are 13,000 miles of h.p. transmission lines. The electric railways are covered in three articles and further articles deal with telephony, telegraphy, and radio.

"Der Wissenschaftlichen Grundlagen der Preisbildung fur die Elektrische Arbeit," by Dr. W. Kummer. Brunswick: Friedr. Vieweg & Sohn, A.G. 4s.—This little book forms No. 100 of the series of the German technical handbooks published by the Brunswick firm of Vieweg. It is from the pen of Dr. W Kummer, one of the engineering professors at the Technical High School of Zurich, who, in a short preface, states that, despite the fact that there is now fifty years' experience of electricity supply undertakings to draw upon, there is still room for improvement in the methods of scientifically determining operating costs and for fixing the rates for electricity supply on a profitable basis, and it is a contribution to this subject that the author now offers. Dr. Kummer first deals with the matter from the consumption point of view, in order to demonstrate the variation which takes place in the daily load and its effect, this being followed by a chapter in which the working costs of steam and hydraulic power stations and of those plants with abnormal load factors are discussed. He makes some suggestions as to the fixing of prices, the subject of uniform tariffs being also discussed.

"*Transactions* of the Institution of Engineers, Australia." Vol. VII, 1926. Sydney, N.S.W.: The Institution.

"*Journal* of the Institution of Engineers, Australia." Vol. I. No. 8. August, 1929. Sydney, N.S.W. Price 7s. 6d.

Bankruptcy Proceedings.

G. F. A. Stone (trading as the Stone Manufacturing Co.), electrical accessories manufacturer, 108, Great Saffron Hill, E.C., and 422, Pinner Road, Harrow.—The first meeting of creditors was held on September 25th, before Mr. V. Armstrong, Assistant Official Receiver, at the London Bankruptcy Court. The debtor petitioned the Court on September 12th, and was adjudged bankrupt the same day. He has lodged a statement of affairs showing liabilities of £1,889 to rank for dividend, against net assets valued at £177, after deducting £68 for payment of the preferential claims. The debtor states that he began business on his own account in 1920, under the style of the General Maintenance Electric Co., at 14, High Street, Pinner, having a capital of between £150 and £200. After trading for twelve months, his business was taken over by the Modern Electric Co., Ltd., and he was appointed sales manager. When that company went into liquidation eighteen months later he restarted business for himself at Finsbury Place under the style of the Lighting Supply Co. That business was successful, and after two years was taken over by a company, of which he acted as joint managing director until July, 1927, when a receiver was appointed and the company was wound up. He again started on his own account, taking premises in Great Saffron Hill, and trading as the Stone Manufacturing Co. The failure is attributed to delay in delivery of raw materials and insufficiency of capital. The case was left in the hands of the Official Receiver. The following are creditors:—

	£		£
Brownie Wireless Co. ...	230	McLeod & McLeod ...	80
Bearfield	37	Maydew	44
Ebonestos Insulators ...	119	Parr's Advertising ...	116
Handells, Ltd.	49	Reyner	70
High Tension Bakelized Products	48	Samuel Lee Batty ...	34
Johnson & Watts ...	100	Spicer's	30
Lewis Banks & Sons ...	214	Turner & Co.	42
		Waines	70

E. R. Millward, trading as "West of England Radio," 67, High Street, Barnstaple, wireless engineer.—The receiving order herein was made on the debtor's own petition on April 29th of this year. According to his statement of affairs, there are liabilities of £1,030, all due to unsecured creditors, against assets estimated to produce £182, leaving a deficiency of £848. The debtor attributed his failure to insufficient profits to meet heavy trade expenses, including motor-car upkeep; giving long-term credit on hire-purchase of wireless sets, whereas his credit was generally one month; costs added to debts by creditors suing; and ill-health. He commenced trading on his own account in December, 1926, with a capital of £25. He states that his financial difficulties were primarily due to the trade being insufficient to meet his expenses, which he estimated at 50s. a week. In January, 1928, a friend guaranteed his bank account to the extent of £20. In April another lent him £100, which has not been repaid, and at various times last year he had been lent sums amounting to £41, of which £34 had been repaid. In November of last year a relative lent him £200 to pay pressing creditors. When he was taken ill in March of this year, the solicitors took charge and disposed of the trade fittings, etc., at the shop for £12, paid the rent to April 13th, and removed the stock. All work was suspended. He states that he first became aware of his position in March last, whereupon he wrote to some of the creditors with the object of getting longer credit in order to pull the business round.

G. T. Baines, 66, High Street, Gorleston, Suffolk, electrical and wireless engineer.—The public examination herein was held recently at Great Yarmouth, when a statement of affairs was produced showing liabilities of £350, and a deficiency of £295. The debtor commenced trading on his own account in 1925 with practically no capital. He sustained an accident a year later, and for two years he was totally incapacitated. In March, 1928, he restarted, with £40 borrowed, which he has since repaid. He states that goods were invoiced to him on a *pro forma* invoice, but were not delivered. The suppliers sued him and judgment was given against him for £22, including £10 for costs. The examination was closed.

J. C. Roger, wireless dealer, &c., 14, The Crescent, 95, Lower Broughton Road, Salford.—First and final dividend of 8½d. in the £, payable October 8th at the offices of Mr. J. F. Warburton, 28, Queen Victoria Stree,t Manchester.

J. H. B. Tattersall (H. Tattersall), electrician, &c., 456, Burnley Road, Scout Bottom, Waterfoot, Lancs.—First meeting October 7th, at the Official Receiver's offices, Byrom Street, Manchester. Public examination November 1st, at the County Police Court, Rochdale.

B. E. M. Pook, wireless dealer, 53a, Albert Road, Southsea. Trustee, Mr. J. L. Wilkinson, Official Receiver, 87, High Street, Portsmouth, released September 20th.

S. W. Richards (Blackwood Radio and Electrical Supply Depôt), radio engineer and electrical contractor, High Street, Blackwood, Mon.—First and final dividend of 7¾d. in the £, payable October 8th at the Official Receiver's office, 34, Park Place, Cardiff.

Company Liquidations.

National Wireless Corporation, Ltd.—Liquidator, Mr. E. T. A. Phillips, Official Receiver, Carey Street, W.C., released September 21st.

Bishops Castle Electric Light & Power Co., Ltd.—Liquidator, Mr. O. B. Wallis, Official Receiver, 133, St. Owen Street, Hereford, released October 20th.

British Union Lamp Works, Ltd.—A meeting of members is called for November 4th at the offices of the British Insulated Cables, Ltd., Prescot, Lancs., to hear an account of the winding up from the liquidator, Mr. A. L. Glencross.

Dissolutions of Partnership.

Connal, Hodgson & Co., electrical engineers and wireless experts, The Smelt, Port St. Mary.—Mr. R. C. Connal and Mr. C. Hodgson have dissolved partnership. Mr. Hodgson will continue the business.

Redcliffe Radio Manufacturing Co., Ltd., radio apparatus manufacturers, Phœnix Works, Temple Gate, Bristol.—Mr L. E. Hicks and Mr. R. G. Hawkins have dissolved partnership. Mr. Hawkins will attend to debts and continue the business.

New Catalogues and Lists.

Messrs. Gent & Co., Ltd., Faraday Works, Leicester.—Book 6b containing descriptive matter relating to liquid-level indicating, recording, and alarm signals for waterworks, &c.

Metro-Vick Supplies, Trafford Park, Manchester.—Brochure No. 7150/8 and folder 7150/9 giving particulars of electric fires, including illustrations of imitation coal fires. A special discount is allowed to retailers on the first order for a specified number of fires.

Houghton-Butcher (Great Britain), Ltd., High Holborn, W.C.1.—Two pamphlets outlining the company's radio hire-purchase system.

Messrs. J. J. Eastick & Sons, Eelex House, 118, Bunhill Row, E.C.1.—A comprehensive catalogue (pp. 243) of wireless and electrical specialities. Numerous illustrations are included and the publication is fully indexed and priced.

The Wholesale Fittings Co., Ltd., 23, 25, 27 and 37, Commercial Street, E.1.—List No. 238 of the company's lighting glassware. Fully illustrated and priced.

Korting & Mathiesen Electrical, Ltd., 711 and 715, Fulham Road, S.W.6.—List No. F.1829, describing and illustrating Kandem "Winlux" shop-window reflectors. Priced.

London Electric Firm, Brighton Road, South Croydon.—A pamphlet notifying the purchase from Messrs. Henry Williams, Ltd., of Darlington, of the branch of their business recently trading as the Arc Lamp Lowering Gear Co. Also several leaflets describing lowering gear and suspension lighting installations carried out by the company.

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British Illuminated Glassware Co., Ltd., High Street, Portslade.—An illustrated price list of lamp shades and bowl fittings.

Messrs. Newton & Wright, Ltd., 471-3, Hornsey Road, N.19.—Publication No. B/29, giving particulars of X-ray tubes, Holway valves, and high-tension accessories, with illustrations and prices.

London Electric Wire Co. & Smiths, Ltd., Church Road, Leyton, E.10.—A catalogue of "Lewcos" radio components, which includes a number of new designs.

British Home and Office Telephone Co., Ltd., 161a-166, Strand, W.C.2.—A leaflet drawing attention to the company's intercommunicating telephone service.

British Electrical and Manufacturing Co., 7 to 13, Clavering Place, Newcastle-on-Tyne.—A brochure issued as a memento of the company's 30 years' experience in the electrical trade, containing illustrations of its various departments.

Simplex Conduits, Ltd., Garrison Lane, Birmingham.—List No. 1,192, dealing with "Simplex" signs, reflectors, and lanterns. Illustrations and prices are included.

Messrs. L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, W.C.2.—A folder advertising the new "Universal" washer and dryer and washer and wringer, also a card drawing attention to the Frink corrective system of illumination.

British Brown-Boveri, Ltd., Trafalgar House, Waterloo Place, S.W.1.—A brochure containing some excellent illustrations of electrically-driven machine tools.

Mr. Eric Marx, Central House, 34/36, Oxford Street, W.1.—A catalogue of the "Electra" range of lighting fittings, with illustrations and prices of modern panel fittings.

Messrs. C. A. Parsons & Co., Ltd., Heaton Works, Newcastle-on-Tyne.—A well-produced general catalogue descriptive of the company's turbines and other products. Some excellent illustrations are included.

Messrs. A. P. Lundberg & Sons, Ltd., 477 to 489, Liverpool Road, Holloway, N.7.—Leaflets Nos. EI.79 and EI.80, dealing, respectively, with two-way controls and the d.p. "Twinob" single-phase motor starting switch.

"G. L." Printing & Publishing Service, 33, Cromwell Avenue, Hightgate, N.6.—Specimen pages from the G. L. wireless retailers' catalogue. The full catalogue contains 116 pages, and can be supplied to retailers with their own name and matter printed on the cover.

Dugdill's Patents, Hazel Grove, Stockport.—A card giving illustrations and prices of lighting fittings; also a sheet containing a list of repeat orders.

Radio Instruments, Ltd., 12, Hyde Street, New Oxford Street, W.C.1.—A showcard advertising the dual astatic h.f. choke, and a novel folder drawing attention to the R.I. screen-grid all-electric 3-valve receiver. The folder has a flap illustrating the receiver, which is connected by a cord and "adaptor" to a "lampholder," which appears at the top of the folder.

Nox Electric Lamp Co., Ltd., Clarence Road Works, Hunslet, Leeds.—A new price list of the company's lamps.

Messrs. Donovan & Co., 47, Cornwall Street, Birmingham.—A leaflet describing ironclad electric isolating links with floating contacts.

General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Catalogue No. SL4,986, giving particulars of stage spotlights. Illustrated and priced.

Automatic Telephone Manufacturing Co., Ltd., Strowger Works, Liverpool.—An illustrated folder dealing with private automatic telephone exchanges.

Messrs. Barber & Colman, Ltd., Brooklands, Manchester.—A number of pamphlets showing the "Shakeproof" lock washers and terminals.

Messrs. Newtons of Taunton, 6, Grape Street, Shaftesbury Avenue, W.C.2.—A folder giving particulars and prices of constant potential battery charging equipment.

Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester.—Publication No. 7,826/1, describing the company's marine electrical installations, with some excellent illustrations of the company's workshops, products and actual installations.

A.E.G. Electric Co., Ltd., 131, Victoria Street, S.W.1.—A circular letter drawing attention to the company's new season's stock of "Furniculus" fires.

Philips Lamps, Ltd., Philips House, 145, Charing Cross Road, W.C.2.—Three illustrated folders advertising "Argenta" opal lamps and "Arlita" internally-frosted lamps.

Midland Electric Manufacturing Co., Ltd., Barford Street, Birmingham.—List No. 178, giving particulars of the company's new extensions, together with illustrations and prices of some of its products.

Brookhirst Switchgear, Ltd., Northgate Works, Chester.—An illustrated leaflet dealing with the application of steering gear motors aboard ship.

New Distributors of Edison Storage Batteries, Ltd., Victoria House, Southampton Row, W.C.1.—A brochure describing the construction of the Edison storage battery with numeoous illustrations of the American company's workshops. Also a number of pamphlets drawing attention to the application of the battery to marine and commercial vehicle work.

Warren Brothers (Middlesbrough), Ltd., 91-93, Grange Road, Middlesbrough.—A booklet containing testimonials regarding the efficiency of the Howard (patent) steam separator on board ship.

Prices of Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.	Price Oct. 1st.	Fortnight's inc. or dec.
a	Acid, Oxalic ... ... per lb.	5½d.	...
a	Ammoniac, Sal ... ... per ton	£60	...
a	Ammonia, Muriate (large crystal) ,,	£52	...
a	Bisulphide of Carbon ... ... ,,	...	...
a	Borax ... ... ,,	£25	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... ... per lb.	3½d. to 4d.	...
a	,, Perchlorate ... ... ,,	5½d.	...
a	Shellac ... ... per cwt.	£13 10s.	...
a	Sulphur, Commercial ... ... ,,	£11	...
a	,, Roll ... ... ,,	£11	...
a	Soda, Chlorate ... ... per lb.	3d.	...
a	,, Crystals ... ... per ton	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	3⅝d.	...
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton	£95 to £100	...
b	,, Wire ... ... per lb.	1/1 to 1/9	...
b	,, Sheet ... ... ,,	1/1 to 2/9	...
p	Babbitts Metal and Anti-friction Metals—		
	Grade I ... ... per ton net	£187	£2 dec.
	Grade II... ... ... ,, ,,	£181	£2 dec.
	Grade III ... ... ,, ,,	£72	...
c	Brass (rolled metal 2" to 12" basis) per lb.	10¾d.	...
c	,, Tubes (solid drawn) ... ,,	1/0¾ to 1/1	...
c	,, Wire, basis ... ... ,,	11¾d.	...
c	Copper Tubes (solid drawn) ... ,,	1/3	...
g	,, Bars (best selected) ... per ton	£110	...
g	,, Sheet ... ... ,,	£110	...
g	,, Rod ... ... ,,	£110	...
d	,, (Electrolytic) Bars ... ,,	£84 15s.	5/- dec.
d	,, ,, Sheets ... ,,	£143 10s.	...
d	,, ,, Wire Rods ,,	£94 15s.	£/- dec.
d	,, ,, H.C. Wire per lb.	11½d.	...
f	Ebonite Rod... ... ... ,,	2/3 to 2/6	...
f	,, Sheet ... ... ,,	2/3 to 2/6	...
n	German Silver Wire ... ... ,,	2/2	...
h	Gutta-percha, fine ... ... ,,	nom.	...
h	India-rubber, Para fine ... ... ,,	10d.	¾d. dec.
i	Iron, Pig (Cleveland No. 8.) ... per ton	72/6	...
l	,, Wire, galv. No. 8. P.O. qual. ,,	£20	£1 dec.
g	Lead, English pig ... ... ,,	£25	...
g	Mercury ... ... per bot.	£22 10s. to £22 15s.	5/- inc.
e	Mica (in original cases) small ... per lb.	3d. to 8/-	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,,	10/- to 20/- & up	...
p	Phosphor Bronze, plane castings ,,	1/3¾	...
p	,, ,, drawn bars & rods ,,	1/5	...
p	,, ,, rolled strip & sheet ,,	1/3¾	...
p	,, ,, wire... ... ... ,,	1/6¼	...
o	Platinum ... ... per oz.	£13 17s. 6d.	...
d	Silicium Bronze Wire ... ... per lb.	1/2½	...
r	Steel, Magnet, in bars ... ... ,,	7½d.	...
g	Tin, Block (English) ... ... per ton	£200 10s. to £200 15s.	£5 5s. to £5 10s. dec.
n	,, Wire, Nos. 1 to 16 ... ... per lb.	3/8	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

In their letter dated September 28th, James Forster and Co. states that there is again no feature of interest to report in the lead market. Demand from consumers is quiet, although consumption is very well maintained, the buying being mostly of a hand-to-mouth nature. Conditions on the Continent are also quiet. Nothing is in sight at the moment to alter the present condition of affairs, and there seems little likelihood of higher prices in the near future.

For Sale.

Leicester Corporation has for disposal one motor-generator set. The Guardians of West Ham Union offer for sale a quantity of second-hand electrical machinery. The West Central Merchandise Mart will sell by auction at York House, Southampton Row, W.C., on October 8th, a stock of English and Continental lighting cables, electrical fittings, and radio goods. (See our advertisement pages to-day.)

Leicester Accepts a Swiss Tender.

At its last week's meeting the Leicester City Council decided to accept a Swiss tender for steam turbine plant at £15,700; the lowest British offer was £17,082. Councillor A. H. Swain, chairman of the Electricity Committee, said that if they eliminated foreign competition they would find that they would have to pay "ring" prices for electrical plant. Councillor Pearce said that half of the cost represented wages; that meant that £8,500 was lost to British workers. Councillor Swain stated that £3,500 of the amount would be spent in England; British manufacturers did not use all British material in their plant.

New French Companies.

Among the companies recently formed in France are the Société Sateco, Paris (9, Rue Murat), capital 1,800,000 fr., to establish electric power transmission lines; the Société Hydro-Electrique du Midi, Paris (54, Boulevard Haussmann), capital 20 million fr., to establish hydro-electric stations in Central France; and La Société Universelle de Radiophonie Automatique (S.U.R.A.), Paris (69-71, Rue de Clichy), capital 250,000 fr.

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Lighting and Power Notes.

Bedford.—Electricity Supply Extensions.—Recently the Corporation Electricity Committee agreed to an extension from Kempston to Wootten Pillinge of the existing 11,000-V supply to meet an increased demand by the London Brick Co. and Forders, Ltd., and for the purposes of a general supply to the intervening rural area. The estimated cost of these works was £4,900. The company has now decided to install 840 kW of additional plant. To meet this further increase in the demand it will be necessary not only to extend the existing main from Kempston to Wootton Pillinge, but also to lay a duplicate main from the generating station to Wootton Pillinge and to provide additional transformers. The Committee has decided to recommend that the necessary works shall be carried out at a cost of £13,400.

Brighton.—Station Extensions.—The Corporation Electricity Committee has decided to proceed with the extensions to the Portobello station in connection with the supply to the sewage outfall works, at a cost of £7,250.

Street Lighting.—The Corporation Electricity Committee has decided to proceed with part of the street lighting scheme to Patcham Place at a cost of £700.

Loan Sanctioned.—The Corporation Electricity Committee has obtained sanction to a loan of £12,200, in connection with the alteration of the system and pressure in the Patcham area.

Colne.—Loan.—The Town Council has decided to apply for sanction to a loan of £4,400 for the supply of electricity to Trawden.

Continental.—Sweden.—The large hydro-electric power station at Lanforsen on the Dalaelven river, which is being constructed jointly for the town of Stockholm and Sandvikens Jaernverks Aktiebolag, will soon be completed. The buildings are ready, and the large Kaplan turbines are being put in; only two turbo-generators are being installed at first, each producing normally 11,000 h.p. with a maximum of 13,000 h.p. A third will probably be installed soon and, as there is room for a fourth, the power station may eventually be able to produce a maximum of 52,000 h.p. The construction costs amount to Kr. 10,000,000.—*Reuter's Trade Service* (Stockholm).

According to *Stockholms Tidningen*, the construction of the hydro-electric station on the Indal River to utilise the power of the Krangede rapids is to begin in 1932, and is to be completed in 1936. The total cost of the undertaking is estimated at about £773,000. When the plant, which will be the biggest privately-owned station hitherto constructed in Sweden, is completed, electric power will for the first time be distributed from a power station in North Sweden to consumers in the central part of the country. The Krangede power plant will have an initial capacity of 50,000 kW, but it is possible that it will be extended to 150,000 kW. The three biggest existing power stations in Sweden are Trollhattan (170,000 h.p.), Porjus (80,000 h.p.) and Alvkarleby (75,000 h.p.), which are all government-owned.

Germany.—A proposal to dam the valley of the Our between Ouren and Stolzenburg, near the Luxemburg frontier, will, when carried out, result in the formation of one of the largest reservoirs in Europe. The reservoir, which, in addition to the Our valley, will also embrace several side valleys, will have a length of nineteen miles and a storage capacity of eight hundred million cu. metres. The water power obtained is to be utilised by the Allgemeine Elektricitäts Gesellschaft for generating electricity, which will be distributed to the existing Rhenish and Westphalian power centres, to Hesse-Nassau, and in a westerly direction to Luxemburg, Belgium and France. The cost of the scheme, which is shortly to be put in hand, is estimated at £6,000,000.—*Reuter* (Cologne).

Belgium.—Rapid progress is being made in connection with the electrification of Eastern Flanders, and it is estimated that, by the end of the current year, 194 out of 197 communes in the province will have a supply of electricity available. The work has entailed the installation of over 390 miles of h.p. transmission lines, 675 miles of l.p. mains, and 327 transformer stations and boxes.

Coventry.—Loan.—The City Council has applied for sanction to a loan of £4,846 for mains extensions.

Price Reduction.—The City Council has reduced the flat rate for power (low-pressure supply) and heating from 1⅜d. to 1½d. per kWh, for lighting from 4½d. to 4d., and for prepayment meters from 5d. to 4½d.

Croydon.—Mains Extensions.—The Corporation Electricity Committee reports that it has already sanctioned expenditure in connection with a supply to the Waddon Mills, amounting to £2,300. An application has been received for a supply to another factory on adjoining land, and the committee recommends that this supply shall be given by extending the cables from Waddon Mills to the factory at a cost of £2,660. The committee has also decided, in connection with further supplies required at the Post Office exchange and other premises in Surrey Street, to lay an e.h.p. main from Drummond Road sub-station to the Surrey Street sub-station, at an estimated cost of £1,800, inclusive of switchgear.

Loans.—The Electricity Committee has obtained sanction to loans of £70,000 for buildings, civil engineering works and concrete cooling tower, and £200,000 for generating plant.

Church Lighting.—The Electricity Committee has considered representations with regard to the price of electricity for the lighting of places of worship, and recommends that where the borough electrical engineer is satisfied that the supply is a non-peak demand and will only be used during the evenings of Sunday and Wednesday, a special discount of 33 per cent. be allowed off the flat rate of 6½d. per kWh.

Darlington.—Fringe Order.—The Corporation has received a letter from the Electricity Commissioners, stating that the Cleveland and Durham Electric Power, Ltd., has applied for a revocation of the Fringe Order under which the Corporation supplies electricity to certain houses in the parish of Haughton-le-Skerne. The Commissioners have asked whether, in the event of the Corporation desiring to continue its supply to the Fringe Order consumers, it would be prepared to take over the powers hitherto held by the company in respect of the parishes of Barmpton, Great Burdon, Haughton-le-Skerne, Norton Palms, Neasham, Sadberge, and Whessoe, and to pay the company compensation for expenditure incurred on works in these parishes. The Electricity Committee has recommended agreement to the suggestion of the Commissioners and making application for a Special Order to supply electricity in the parishes named.

Dover.—Bulk Supply.—The Corporation Electricity Committee has recommended that a scheme put forward by the Central Electricity Board for the shutting down of the local plant and for the taking of a bulk supply shall be agreed to in principle, and that a more exact estimate of the total cost be obtained. According to the proposed scheme the bulk supply would be taken from the Board's sub-station near Folkestone at 33,000 V and reduced to 6,600 V, by means of transformers and switchgear provided by the Board. The supply would be metered at 6,600 V, and the price paid for the supply would be as follows:—Not exceeding £3 17s. 6d. per kW of maximum demand during any half-hour in the months of November and December in the year of account plus 0.2d. per kWh supplied, the "unit" charge to be subject to an increase or decrease of 0.001d. for each penny by which the cost of delivering coal to the Board's stations shall rise above or fall below 16s. 6d. per ton A contribution of £6,000 would be made towards the cost of changing the frequency.

East Ham.—New Cables.—The Corporation Electricity Committee has passed an estimate for distributor cables of £3,308.

Guildford.—Loan.—The Corporation Electricity Committee is to seek sanction to a loan of £20,000 for mains and services.

Two-part Tariffs.—The Town Council has adopted the following two-part tariffs:—Commercial lighting, £15 per kW plus 1d. per kWh. Private dwelling houses, 15 per cent. on rateable value up to £60, 12½ per cent. from £61 to £75, 10 per cent. from £76 to £100, and 7½ per cent. beyond, with a charge of ¾d. per kWh in the old area, and 1d. per kWh in the outer area.

Huddersfield.—Loan.—The Town Council has applied for sanction to a loan of £60,000 for mains, services, and transformers.

India.—Mandi Hydro-electric Scheme.—It is understood says *Indian Engineering*, that the Mandi Hydro-electric Scheme will, on completion of its first stage, supply energy for nineteen towns. This is one of the largest projects undertaken by the Punjab Government and is a purely official enterprise. Of the nineteen towns, three are in Indian States, and in these the local distribution will be done by State agency. Out of the remaining sixteen towns, there are only five which are at present supplied with electricity. Of these Lyallpur is supplied with power by the Hydro-electric Department, while Amritsar has entered into a contract for ten years to obtain all its requirements from the same department. This leaves only three towns in which Company licences exist. Though no licensees can be forced to take power from the Government, it is anticipated that the rates at which power can be offered for sale will be sufficiently attractive to induce them to purchase all their power from the Hydro-electric Department.

Kingston-on-Thames. — Plant Extension. — The Town Council has received sanction to a loan of £41,678 for the installation of additional plant at the electricity works.

Lincoln.—Water Shortage Difficulties.—Owing to the drought the Electricity Department is being faced with serious difficulties with regard to obtaining water for its generating station. The River Witham has fallen to such a degree that water has had to be pumped from a sewage farm. It is stated that if the river falls another two feet, the supply of electricity to local engineering works may have to be discontinued.

London —Fulham.—In connection with the proposed scheme estimated to cost £10,350 for improving the lighting of the main roads of the borough, the Electricity Committee has recommended the expenditure of £554 on an experimental system of central lighting in Harwood Road.

Hammersmith.—The Borough Council has agreed to accept a quotation from the London and Home Counties Joint Electricity Authority for a bulk supply of electricity to meet the whole

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requirements of the Council's electricity undertaking, subject to satisfactory terms being arranged.

Hornsey.—The Borough Council Electricity Committee is seeking sanction to loans of £20,000 for general mains extensions and £10,000 for house services.

Lowestoft.—Loan Sanctioned.—The Corporation Electricity Committee has received sanction to a loan of £5,000 for the purchase of meters.

Bulk Supply.—At a meeting of the Corporation Electricity Committee held recently, the electrical engineer reported that the removal of the remainder of the steam plant at the electricity works had been carried out, and that it was expected to complete the installation of the two last convertors within the next few days. When the work has been completed the whole of the supply of electrical energy will be taken from Great Yarmouth. Arrangements have been made for the employés who will be discharged from the electricity works to be engaged at the artificial silk factory at the same rates of pay as they are now receiving.

Maidenhead.—Loan.—The Town Council has applied for sanction to a loan of £8,406 for mains extensions and substation equipment.

Maidstone.—Mains Extensions.—The Town Council is to carry out mains extensions in Linton Road at an estimated cost of £1,800, and to the village of Ditton at an estimated cost of £1,735.

New Mills.—Electricity Supply.—The Urban District Council has decided to carry out an electricity scheme for the district at an approximate cost of £27,000. The electrical energy will be supplied by the Trent Valley and High Peak Electricity Co., Ltd., who will purchase it in bulk from the Stockport Corporation.

Northern Ireland.—Antrim.—The ceremony of switching on the electricity supply was performed on Saturday, September 21st, by Mr. W. T. Cooper, chairman of the Antrim Town Commissioners.

Scarborough.—Loan.—The Corporation Electricity Committee has decided to apply for sanction to a loan of £40,000 for mains, services, and meters.

Sheffield.—Mains Extensions.—The Corporation Electric Supply Committee has approved an expenditure of £5,542 on mains extensions.

Sittingbourne and Milton Regis.—Electricity Charges.—The Kent Electric Power Co., which is laying mains in the two towns, has informed the Urban District Councils that the price of electricity will be 6½d. per kWh for lighting, and 2½d. per kWh for cooking.

South Africa.—Durban.—The statistics of the municipal electricity undertaking for the financial year ended July 31st last show that the electrical energy sold totalled 80,733,496 kWh, an increase of 15.5 per cent. as compared with the preceding year. Of the total sold the domestic heating and cooking load accounted for 27,544,572 kWh, which was an improvement of 32.2 per cent. as compared with 1927-28. During the year 1,339 cookers were installed, and although there was a slight decrease in the number of water heaters installed, the *South African Engineer* points out that this merely indicates that the "saturation" point is being approached in this respect. An increase of 72 per cent. took place in the number of electric refrigerators installed—260 as against 151 in the previous year. Since the inception of the hire-purchase scheme in 1925, approximately 3,000 agreements have been made with consumers.

Cape Town.—During 1928, the sales of electricity by the Corporation Electricity Department totalled 61,590,009 kWh, as compared with 55,131,999 kWh in 1927. Although the rate of increase was not so great as in previous years, this was due entirely to the inauguration in June, 1928, of the Salt River power station which took over the load of the South African Railways and Harbours Administration, amounting to 7,000,000 kWh, from the Corporation power station. The normal increase in consumption by private consumers, however, is such that the loss will be made up within 18 months.

Port Elizabeth.—The Corporation electricity undertaking is rapidly developing, the sales of electricity during 1928 amounting to approximately 12¼ million kWh, as compared with less than 5½ million kWh in 1923, whilst the sales for 1929, based on the first seven months' working are estimated at 20½ million kWh. The increasing demand for electricity has been so great that it has not been possible to wait until the new 10,000-kW set is available and consequently a 3,000-kW set has been purchased from Durban Corporation as an emergency measure. The installation of this set is nearing completion and it will be put into commission shortly. Tenders have been received for the 10,000-kW turbo-alternator, steam-raising plant and auxiliaries.

Special Orders.—Application has been made to the Electricity Commissioners by the Old Silkstone Collieries, Ltd., for a Special Order authorising it to supply electricity in the urban districts of Holme Cultram and Wigton, in the rural districts of Alston-with-Garrigill, Bootle, Brampton, Longtown, Penrith and Wigton, and in a part of the rural district of Carlisle. Application has also been made to the Commissioners by the Newcastle-upon-Tyne Electric Supply Co., Ltd., to amend the draft Special Order so as to include in the area of supply the parish of Aydon Castle in the rural district of Hexham.

The Electricity Commissioners have submitted to the Ministry of Transport for confirmation a Special Order made by them authorising the Harrogate Corporation to supply electricity in the urban district of Knaresborough and in parts of the rural districts of Pateley Bridge and Great Ouseburn.

Sutton Coldfield.—Year's Working.—The accounts of the Corporation electricity undertaking (engineer: Mr. Thomas Bloore) for the year ended March 31st last show a total revenue of £35,594 and a working expenditure of £18,598, leaving a gross profit of £16,995. To the gross profit was added £298, being the balance from sale of fittings, making a total of £17,293 available, and after providing for capital and other charges there was a net surplus of £5,961. The capital expenditure during the year amounted to £10,794, the chief item of which was £4,402 for mains. The total capital expenditure to the end of the year was £162,694. The electrical energy sold increased from 2,122,291 to 2,552,196 kWh, and the maximum supply demanded from 1,494 to 1,971 kW.

Warrington.—Year's Working.—We have received from Mr. F. V. L. Mathias, borough electrical engineer, a copy of his report and a statement of accounts of the electricity undertaking for the year ended March 31st last. The total revenue increased from £133,771 to £134,301, and the working expenses fell from £79,488 to £77,315. The gross profit was £56,986, as compared with £54,284 in the preceding year, and to it was added interest on investments and bank interest, making a total of £58,612 available. From this the following charges had to be met: Interest on loans, £15,275; contribution to sinking fund, £14,387; income tax, £6,125; capital expenditure out of revenue, £4,362. There remained a net surplus of £18,464, as compared with £18,964 in 1927-28. The capital expenditure during the year amounted to £18,320, the principal item being £13,958 for mains and services. The total now spent on the undertaking stands at £565,996. The sales of electricity, excluding the tramway supply, increased from 20,327,260 to 22,838,857 kWh, and the maximum supply demanded from 9,600 to 10,200 kW. The average price obtained per kWh was 1.27d.

Wimbledon.—Water Heating Tariff.—At a recent meeting of the Corporation Electricity Committee, the borough electrical engineer outlined a scheme under which it would be possible to offer electricity at ½d. per kWh for water heating during the hours from 11 p.m. to 7 a.m., and reported that the adoption of this scheme would have the effect of considerably increasing the night load of the undertaking. The Committee authorised the electrical engineer to take the necessary steps to put the scheme into operation at the earliest date.

Loans.—The Corporation Electricity Committee is to apply for sanction to the borrowing of £30,000 for mains and services. The Committee has obtained sanction to loans of £15,000 for domestic apparatus to be let out on hire, and £2,500 for substation equipment.

Tramway and Railway Notes.

Bradford.—Railless Cars.—The substitution of railless cars for tramcars on the Allerton route is expected to take place towards the end of this month.

Chester.—Tramway Abandonment.—The Corporation has decided to abandon its tramway system in January next and to substitute motor-omnibuses.

Continental.—Sweden.—According to a Gothenburg paper, it is planned to electrify the private railway between Gothenburg and Boraas, which is 72 kilometres long.—*Reuter's Trade Service* (Stockholm).

East Ham.—Proposed Tramway Extension.—At a recent meeting of the Corporation Tramway Committee, the town clerk submitted a letter from the Ministry of Transport enclosing a copy of a letter received from the Metropolitan Municipal Tramways Council regarding the suggested extension of the tramway system from Barking, through Longbridge Road and Valence Avenue to Romford High Road, in order to serve the Becontree Estate. The letter stated that the Minister would be prepared to arrange a conference of representatives of the local authorities concerned for the purpose of a preliminary discussion of the proposal, and he would be glad to know whether the Corporation was willing to be represented. The Committee recommended the appointment of representatives to attend the conference on the Council's behalf.

Northern Ireland.—Belfast.—The Corporation Tramway Committee has decided to apply for sanction to run railless cars in the city.

Stockton.—Tramway Abandonment.—The Corporation has decided to abandon its tramway system and substitute 'buses. It is stated that £80,000 would have been required to renew the track on the Thornaby and Stockton section of the service.

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The L.M. & S. Railway.—Carriage Lighting.—A scheme sanctioned by the Ministry of Transport for the development and modernisation of the London Midland and Scottish Railway includes the expenditure of £200,000 on the conversion of gas-lighted carriages to electric lighting

The Southern Railway.—Breakdown.—The failure of a rotary convertor at the Lewisham sub-station on Friday last, at 10.25 p.m., was the cause of a breakdown affecting the whole of the Southern Railway's suburban system. The lights at every station were extinguished, and the new electric signalling apparatus also failed. The service was resumed shortly before 11 p.m.

United States.—New York.—A fire, which broke out at the power station at the Grand Central Railway station shortly before 9 p.m. last Saturday, suspended throughout the night the traffic on the most congested northerly traffic routes out of the city. The Grand Central Railway station not only serves the northern suburbs of New York, but is also the terminus for the main line traffic to the principal towns in New England and for the international express lines to Canada. Electric power is used to propel these main-line trains from the station, a transfer to steam being effected outside the city.

Telegraph and Telephone Notes.

America.—Telephone Industry.—Figures recently published by the United States Census Bureau concerning the quinquennial census of telephones show that there were 18,522,767 telephones in use in the United States on December 31st, 1927, an increase of 29.1 per cent. since 1922. The number of telephones in every State increased, the largest increases being in Florida, 103.7 per cent.; California, 57.9 per cent.; Louisiana, 57.5 per cent.; and New Jersey, 56.3 per cent. In the same period the industry's investment in plant and equipment grew from $2,205,183,000 to $3,548,874,000, a gain of 60.9 per cent. The single wire mileage increased since 1922 by 71.3 per cent., amounting in 1927 to 63,836,182. The number of employés increased by only 20.3 per cent. since 1922, while the number of calls handled in 1927 showed an increase of 28.3 per cent. over 1922.

Code Telegrams.—New Rules.—In accordance with the decision of the International Telegraph Conference held at Brussels in September, 1928, new rules for the use of code words in telegrams for abroad came into force on October 1st and will operate on international telegraph routes, whether cable or wireless, throughout the world.

Egypt.—Radio-telephony.—The Egyptian Ministry of Communications has submitted for financial approval a scheme for a wireless telephone service from Egypt to England, with an extension to the Continent.

Empire Communication. — Transfer. — The Postmaster-General announced that on September 29th the working of the Imperial telegraph cables and of the beam wireless services to the Dominions and India (the telegraph systems known as "Imperial" and "Empiradio") were transferred from the Post Office to Imperial and International Communications, Limited, the company recently formed to take over (as recommended by the Imperial Wireless and Cable Conference of 1928) the services of the Post Office as well as the services of the Pacific Cable Board, the Eastern Telegraph Company, Ltd., and Marconi's Wireless Telegraph Co., Ltd. The overseas telephone services and the Anglo-Continental telegraph services operated by the Post Office are not affected by the change.

Radio Notes.

Egypt.—Broadcasting Scheme.—Several Powers have asked the Egyptian Government for a copy of the law on wireless in Egypt and the Government has replied that no legislation exists at present. A representative of the Marconi Co. has met the Minister of Communications to discuss a scheme for broadcasting in Egypt.

France.—Loud-speaker Curfew.—The mayor of the town of Chateldou, in the Auvergne district, has signed an order prohibiting the use of wireless installations provided with loud-speakers after 10 p.m. in summer and 9 p.m. in winter. The order followed complaints made by several inhabitants.

Germany.—Licences.—Dr. Wagemann, president of the Institute for Trade Situation Research, recently told the Society for German Economic Propaganda that in Germany in 1928 users' licences yielded 55,000,000 marks, and the number of subscribers amounted to about 3,000,000. That considerable growth of the number of wireless subscribers in Germany was probably shown by a comparison with other countries: thus, in the United States he stated that in 1928 there were 8.4 wireless sets to every 100 inhabitants; in Sweden, 6.1 per 100; in England, 5.5 per 100; and in Germany, only 3.9 per 100. The exports from Germany last year, valued at 50,000,000 marks, were considered to be remarkably high, being almost as much as in the United States, and about twice the value of the English exports. The German industry was said to be confronted with the problem of the extension of markets; lack of working capital hampered the industry, rendered difficult the promotion of sales by the grant of credits, especially to foreign customers, and it involved the danger of German undertakings passing under foreign control.

Licences.—Prosecutions.—During the past four years 3,230 prosecutions have been undertaken by the British Post Office authorities under the Wireless Telegraphy Acts.

Regional Station.—Brookman's Park Tests.—The B.B.C.'s new London regional transmitter at Brookman's Park is now radiating the last section of the London programme each night, excluding Sundays, commencing on September 30th, which portion of the programme is the late dance music, lasting for about 1½ hours and terminating at midnight. The test transmissions which have been radiated from Brookman's Park between midnight and 1 a.m. since September 16th ceased after the night of September 28th-29th; but the morning transmissions between 11.30 and noon will be continued for the present. No test transmissions will be radiated from Brookman's Park on Sundays.

Switzerland.—Regional Stations.—Following Britain and Poland, the Swiss service is to be reorganised. The country has two exclusive wave-lengths only. For the German-speaking portion of the country a station is to be erected at Münster, twelve miles north-west of Lucerne, near Lake Sempach. It will use the 459-metre wave and have 25 kW aerial power, with provision for increasing it to 50 kW. It will be fed from studios at Berne, Zürich, and Basle, and be relayed by the Tessin station. For the French-speaking part of the country a station will be built at Sottens, near Mondon, north-east of Lausanne. It will operate on the 403 metre wave and be of 12.5 kW power, capable of being increased to 25 kW. It will be fed by studios at Geneva and Lausanne, and relayed by the Geneva local plant, which will be of 1 kW and use the 680 metre wave; it will be situated on a height called St. Georges down the River Rhone. By September, 1930, this first part of the reorganisation scheme, for which credit has been voted, should be complete. About six months later a 3-kW, 760-metre station will be opened on Monte Cenere, midway between Lugano, Locarno, and Bellinzone, in Tessin Canton, to serve the Italian-speaking part of the country. When the actual radius of each of the new stations has been proved, the Swiss Administration will consider the putting into practice of the second part of the scheme, namely, the erection of local stations in Berne, Basle, St. Gallen, and perhaps Zürich, of one kilowatt on a common wave. The third and last part of the scheme would be the erection of two 1-kW stations in the Valley at Sion and in the Grisons at Chur; this, however, will be done only if it is found that these stations are absolutely necessary. The Swiss Telegraph Department will erect and operate the stations, says *World Radio*, and in consideration will retain a slightly larger proportion of the licence fees than hitherto. The programmes will be furnished by two companies, and the stations will be interconnected.

Autumn Illuminations at Blackpool.

The Blackpool illumination season is now in full swing, and every evening until October 21st the four miles of promenade will be lit up at dusk. Approximately £9,000 has been spent by the Corporation Electricity Department on planning and executing the lighting scheme, and it is computed that the Corporation's share of the illuminations is at least 100,000 electric lamps of many colours. This year the extent of the illuminations is greater than in preceding years owing to the proprietors of the three piers having decided to illuminate their properties independently. Each structure is outlined with white lamps, and the minarets are flooded. Four 50-kW generators have been put in commission to deliver electricity from the overhead traction wires. The suply is drawn from the local power station, assisted by the bulk supply which is taken from Preston. The town hall in Talbot Square is the principal centre of the illuminations, and this building alone displays about 6,000 lamps. The illumination of the town hall each evening is the signal for all the other buildings and the numerous other decorative features to be switched on. In Talbot Square a score of tall illuminated pylons carry festoons of coloured lamps, and in front of the town hall there are moving set-pieces of waterfalls, fountains of light, rising and setting suns, stars, &c. All the electric lamp standards along the promenade are enclosed in decorative lanterns. The tramway stops are distinguished by pillars of light, and even the kiosks are decorated with 420 lamps each. Twenty toast-rack tramcars each carry 100 lamps, an illuminated tramcar 4,000 lamps, and an illuminated windmill 3,000 lamps. A number of motor flashers is used to work the various moving devices. Facilities were provided by the Corporation Electricity Committee for householders, shopkeepers, hotel proprietors, and others to acquire lighting units, lamps, and strip wiring, &c., on loan from the department at extremely modest rates.

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Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Argentina.—Buenos Aires.—November 4th. Argentine State Railways. Turbo-generator sets and headlights for locomotives. (B.X. 5657.)*

Australia. — Melbourne. — State Electricity Commission. December 16th. Oscillograph equipment. (B.X. 5692.)*

Posts and Telegraphs Department. November 12th. Telephone receivers and parts. (B.X. 5656.)* Transmitters and parts. (B.X. 5653.)*

November 19th. Telephone generators and motor-generators. (B.X. 5662.)*

November 19th. Motor-generators. (B.X. 5694.)*

November 26th. Vitreous resistances. (B.X. 5696.)*

November 27th. City Council. 6,600 3-phase switchgear. (B.X. 5708.)*

Sydney.—October 29th. New South Wales Government Railways. Railway traction motor-testing equipment. (B.X. 5693.)*

Belfast.—October 21st. Electricity Department. Supply and delivery of circulating water pipes. (See this issue.)

Brighton.—October 11th. Corporation. Supply of gasfilled lamps for street lighting purposes for a period of one year from November 1st next. (See this issue.)

Cardiff.—October 21st. Electricity Department. Supply and erection of a water-tube boiler, mechanical stokers, and fuel economiser. (See this issue.)

Edinburgh.—October 7th. Education Authority. Electric lighting and heating installation at Portobello Secondary School. Schedules, &c., from Mr. J. A. Carfrae, architect, 3, Queen Street, Edinburgh.

Egypt.—Cairo.—November 5th. Department of Public Health. Electric refrigerators for 12 months.—*Reuter's Trade Service* (Cairo).

Glasgow.—October 8th. Tramways Department. Water-tube boiler plant, one 10,000-kW turbo-alternator with condensing plant and auxiliaries, and e.h.p. switchgear and control gear for Pinkston power station. (September 20th.)

Halifax.—October 7th. Waterworks Committee. Electrician's work in connection with the erection of filter house, &c. Particulars from Mr. A. C. Tipple, borough engineer (deposit £2 2s.).

Hastings.—October 23rd. Electricity Department. 22,000 V, 3-phase overhead lines and underground cables, Crowhurst Section, No. 6 (approximately 7,000 yards.) 400 V 3-phase, 4-wire overhead lines and underground cable, Crowhurst Section, No. 7 (approximately 4,200 yards.) 400 V, 3-phase, 4-wire, overhead lines and underground cable, Whatlington Road, Section No. 8 (approximately 1,000 yards.) (See this issue.)

India.—October 11th. South Indian Railway Co., Ltd., Madras. Electrification of suburban services, overhead contact and distribution lines. (September 13th.)

Delhi.—December 3rd. India Stores Department. Ceiling and table fans. (B.X. 5672.)*

London.—Great Western Railway.—October 8th. Supply from November 1st of telegraph instruments, electrical apparatus (insulators), &c., electric wires and cables, and electric lamps. (September 20th.)

Southwark.—October 22nd. Borough Council. Electric cables for 12 months. (September 13th.)

Central Electricity Board.—November 9th. Supply, delivery, and erection of 33,000-V overhead transmission lines in South Lincolnshire. (September 27th.)

Manchester.—October 10th. Education Committee. Electric lighting installation at Birchfields Municipal School, Rusholme, and North Manchester High School for Boys, Moston. Specification (deposit £1 1s.) from Education Offices, Deansgate.

October 23rd. Electricity Committee. Supply, delivery and erection of four 33,000-V, 500,000-kVA rupturing capacity switch units, and two 10,000-kVA, 33,000/6,600-V indoor-type transformers. (See this issue.)

Morocco.—Tetuan.—October 10th. Public Telegraph Service. Telegraph posts, insulated copper wire, insulators, g.i. supports, and copper binding wire. (B.X. 5706.)*

New Zealand.—Wellington.—Post and Telegraph Department. November 12th. Four-conductor operator cords. (B.X. 5685.)*

October 8th. Indicator alarm fuses. (B.X. 5714.)*

Public Works Department. November 12th. 15-kW oil-engine-driven generating set for installation on the "Main Pomare." (B.X. 5683.)*

Auckland.—Auckland Electric Power Board. November 4th. Distribution pillar shells and link units and cable sealing ends. (B.X. 5682.)*

Sidmouth.—October 7th. Supply, delivery, and laying and erection of l.p. paper-insulated feeders and additional overhead l.p. mains. (September 27th.)

Sleaford.—October 10th. Electricity Department. Supply and erection of one slate control panel with s.p. breaker, switch, &c. (September 27th.)

Southend-on-Sea. — Electricity Department. Supply of 1,500 current limiters. (September 20th.)

Electric Lighting Department. Supply of 2,000 pairs of house service fuse boxes. (September 27th.)

South Africa.—Johannesburg.—October 17th. Municipal Council. Supply of tramcar motors. (B.X. 5664.)*

Salisbury.—October 17th. Municipal Council. H.p. cables, transformers, &c. (B.X. 5604.)*

Turbo-alternators, steam piping, crane and switchgear. (B.X. 5607.)*

Staffordshire.—October 31st. Education Committee. Installation of electric light in two new elementary schools in course of erection at Brierley Hill. (September 27th.)

Wakefield.—October 15th. West Riding Education Committee. Installation of electric light at Thurlstone new schools. Particulars from the Education Officer, County Hall, Wakefield.

Ysceifog (Holywell).—October 12th. Installation of electric light at St. Mary's Church. (See this issue.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Barking Town.—Electricity Committee.

Supply of cable in connection with supply to Becontree, from Upney to Gale Street :—

Ateliers de Constructions Electriques de Charleroi. (Recommended.) ...	£1,809
Power & Lighting Cables, Ltd.	1,953
Enfield Cable Works, Ltd.	2,035
W. T. Glover & Co., Ltd.	2,066
Callender's Cable & Construction Co., Ltd. ...	2,071
Hackbridge Cable Co., Ltd.	2,075
Pirelli-General Cable Works, Ltd. ...	2,075
Siemens Bros., & Co., Ltd.	2,096
Union Cable Co., Ltd.	2,101
Standard Telephones & Cables, Ltd. ...	2,109
Johnson & Phillips, Ltd.	2,116
W. T. Henley's Telegraph Works Co., Ltd. ...	2,120

Two truck type cubicles for Upney sub-station (£176), and two for works of Messrs. Warne & Co. (£176).—New Switchgear Co., Ltd. (accepted).

Supplying and laying cable from Axe Street to sewage works :—

Siemens Bros. & Co., Ltd. (Recommended) ...	£2,779
Callender's Cable & Construction Co.	2,851
Standard Telephones & Cables, Ltd.	2,872
W. T. Henley's Telegraph Works Co., Ltd. ...	2,876
Johnson & Phillips, Ltd.	2,884
Enfield Cable Co., Ltd.	2,919

3,300 yd. of cable for lighting the by-pass road.—Siemens Bros. & Co., Ltd.

Bedford.—Electricity Committee. Accepted :—

Overhead line to Ridgmont (£498) and overhead line to Lidlington (£355).—Robert M. Russell.

Recommended :—

Six-wire overhead line to Wootton Pillinge (£2,843).—Pirelli-General Cable Works, Ltd.

Birmingham.—

Electrical installation at Quinton Hall.—Walker & Co.

Brighton.—Electricity Committee. Recommended :—

H.p. switchgear (£650).—A. Reyrolle & Co., Ltd.

Two 300-kVA transformers (£400).—Ferranti, Ltd.

Canterbury.—Board of Guardians.

Mr. G. E. Dashwood has been appointed as electrician to the institution for a period of six months.

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Dublin.—County Borough Commissioners. Accepted:—
Motors, automatic starters, and starting switches in connection with the equipment of the municipal abattoir at the North Circular Road (£447).—North British Lifting and Moving Appliance Co., Ltd.
Electrically-driven automatically controlled pumps, with fittings and auxiliary machinery at three pumping stations (£3,635).—Mather & Platt, Ltd.
—Irish Builder and Engineer.

Epsom.—The Board of Guardians. Accepted:—
Installing electric light in a portion of the Institution, including the boardroom, chapel, dining hall, and kitchen (£114).—Alpha Manufacturing Co., Ltd.

Halifax.—Tramways Committee.
Phono electric trolley wire.—Equipment and Engineering Co., Ltd.

Ilford.—Electricity Committee. Accepted:—
Two kiosks, complete with 300-kVA transformer, h. and l.p. switchgear (£749); one 165-kVA transformer to replace 100-kVA ditto in kiosk (£104); two steel cubicles (£118).—Crompton Parkinson, Ltd.

Kettering.—Electricity Department. Accepted:—
E.h.p. lead-covered armoured cable (£866).—Union Cable Co., Ltd.

London.—Shoreditch.—Board of Guardians:—
Six months' supply of electrical goods.—Metro-Vick Supplies.

Maidenhead.—Town Council. Accepted:—
Rectifier plant for a sub-station (£1,231).—Hewittic Electric Co., Ltd. E.h.p. switchgear.—Drake & Gorham (Wholesale), Ltd.

Rugby.—Urban Council. Accepted:—
Cable, &c., for the Barby Road extension (£1,068).—W. T. Henley's Telegraph Works Co., Ltd.

Southend-on-Sea.—Town Council. Accepted:—
Copper trolley wire (£409).—Union Cable Co.
H.d. copper trolley wire (£242).—British Insulated Cables.
36 medium and 6 heavy traction poles for tramways (£376). British Mannesman Tube Co., Ltd.
Motor for sewage pumping station (£246).—General Electric Co., Ltd.
Rectifiers for adapting eliminator units to a.c. supply (£2 2s. 7d. each for 100 to 250).—E. K. Cole, Ltd.

Staffordshire.—
Electrical installation for the extension to the North Staffordshire Technical College (£466).—C. Ramsay and Co. (S. Shields).

Stoke-on-Trent.—Electricity Committee. Accepted:—
Four superheaters for water tube boilers at central power house (£1,243).—Stirling Boiler Co., Ltd.
Two economisers (£5,262).—E. Green & Son, Ltd.

Walton-on-Thames.—Urban Council. Accepted:—
Various cable.—Pirelli-General Cable Works, Ltd.
300 yd. of .0145 service cable.—Croydon Cable Works, Ltd.
Standard feeder pillar.—Lucy, Ltd.

West Ham.—Borough Education Committee. Accepted:—
Installing electric light in the extension of Plaistow secondary school (£570).—Harland & Wolff, Ltd. The highest tender was £1,185.

Forthcoming Events.

Exhibition of Inventions.—October 2nd-12th. Central Hall, Westminster, S.W.

Institution of Welding Engineers.—Thursday, October 3rd. Caxton Hall, S.W. 7.30 p.m. Lecture on "Impressions of American Industries including Welding." Mr. E. A. Atkins.

Diesel Engine Users' Association.—Friday, October 4th, Caxton Hall, Westminster, S.W. 6 p.m. "Indicating Oil Engines." Mr. G. B. Fox.

Salford Technical and Engineering Association.—Saturday, October 5th. Royal Technical College, Salford. 7 p.m. "An Automatic Electric Sub-Station." Mr. A. E. Clarke.

Illuminating Engineering Society.—Tuesday, October 8th. Lighting Service Bureau, 15, Savoy Street, W.C. 6.30 p.m. Report on Progress in Illuminating Engineering.

Institute of Marine Engineers.—Tuesday, October 8th. The Institute, 1, Minories. 6.30 p.m. "Electric Propulsion as applied to Passenger Liners." Mr. E. Berg.

Institute of Wireless Technology.—Wednesday, October 9th. Engineers' Club. 7 p.m. Annual General Meeting.

Nottingham Society of Engineers.—Friday, October 11th. Mechanics' Institution, Nottingham. 7.30 p.m. Annual General Meeting.

Electrical Power Engineers' Association (North-West Midland Section).—Friday, October 11th. Engineering and Scientific Club, Wolverhampton. "A.c. Meters." Mr. R. J. Rennie.

Institution of Engineering Inspection.—Friday, October 11th. Royal Society of Arts, John Street, Adelphi, W.C., 5.30 p.m. "The Chemical Laboratory in Inspection," Mr. E. F. Law.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope

We should be glad to learn the names and addresses of makers of the following:—

Texa automatic fuses.

Notes.

Smoke Abatement.

The Coal Smoke Abatement Society and the Smoke Abatement League of Great Britain are holding a conference at the Palace Hotel, Buxton, from October 4th to 6th. One of the papers to be read will deal with "The Industrial Uses of Electricity and their Development," while the Conference will see the birth of a new national organisation for combating smoke. The League has in the past confined its attention mainly to the provinces, while the Society has worked chiefly in London. The fusion of the two will greatly strengthen the growing movement against smoke, and the new body, the name of which will be chosen at Buxton, will have its central offices in Manchester, and will also have offices in London and Glasgow. One of the first steps will be the publication of a periodical dealing with the subject, to be entitled "Clean Air," and of which the first number will be issued in November, at the time of the important Manchester Smoke Abatement Exhibition.

Illuminating Engineering Society.

The following series of ordinary meetings have been arranged for the 1929-30 Session:—October 8th: Opening Meeting; November 8th: "Modern Incandescent Lighting in Kinema Studios," Messrs. W. H. Villiers and S. G. Double; December 10th: "Nature and Effects of Glare," Mr. W. S. Stiles; January 21st: "Stage Lighting," Mr. H. C. Ridge; February 18th: Discussion on "Problems in Illuminating Engineering"; March 18th: Paper on "The Lighting of a large Liner"; April 8th: "Textile Lighting," Mr. S. Anderson; May 6th: "Luminous Traffic Signals," Mr. T. Austin.

Appointments Vacant.

Meter repairer and meter tester for the Hull Corporation Electricity Department; resident assistant engineer for the Brentwood Mental Hospital; mains superintendent (salary, Class F, Grade 3) for the County Borough of Blackburn; commercial assistant for Nuneaton Corporation Electricity Department; borough electrical engineer and manager (£1,000), for Wolverhampton Corporation; sub-station fitter, for Stockport Corporation. (See our advertisement pages to-day.)

The Electrical Association for Women.

The 1929 autumn and winter London fixtures of the Electrical Association for Women include: October 10th, visit to Kelvinator, Ltd., and lecture on "Electrical cold that keeps," by Mr. F. E. Kewley; November 7th, visit to Messrs. Shoolbred, Ltd., and lecture by Mr. W. J. Jones, M.Sc., on "Electric light and eyesight preservation"; November 27th, lecture by Mr. E. E. Sharp on "Some electrical experiences in Australia"; December 11th, visit to Messrs. Berry's Electric, Ltd.; and a lecture-demonstration on "Electric Christmas cooking," by Mrs. A. Mole; December 20th, display of kinematograph films arranged by the British Electrical Development Association.

On October 2nd, the Manchester and Salford branch of the Association will inaugurate its winter programme with a "Bring and Buy Sale" which will be held in the Electricity Showrooms of the Salford Corporation. On October 16th the branch will hold a luncheon at the Midland Hotel when the principal speakers will be the Lady Mayoress of Manchester, Lady Emmott, J.P., Lady Brooks, J.P., and Miss Hazlett.

Model Agreement for Wayleaves.

The Times (September 23rd) states that a conference of representatives of the Central Landowners' Association, the Land Agents' Society, and the Surveyors' Institution, has prepared a draft model agreement for the use of landowners granting wayleaves for the passage of electric lines across their property. This agreement, which, with an explanatory memorandum, is printed in the September issue of the *Journal* of the Central Landowners' Association, has been accepted by the Central Electricity Board, and can, it is thought, be adopted in most cases. The conference has also drawn up a scale of wayleave rentals, which ranges, according to the voltage of the lines and the character of the poles, from £2 per steel tower for 60,000-volt lines down to 1s. per leg or stay for woodon poles in hedgerows and on moorland and waste ground for lines carrying up to 12,000 volts. The suggested rentals do not cover compensation for damage or loss of amenity.

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Manchester Electro-Harmonic Society.

The Manchester Electro-Harmonic Society has completed arrangements for the eleventh season, and, as hitherto, a series of smoking concerts will be held at intervals of a month, commencing with October 18th.

Birmingham Electric Club.

The programme of meeting for the 1929-30 session includes the following:—

October 18th.—Ladies' night.
October 25th.—"Motor Users and the Frequency Change," Mr. T. A. Windebank.
November 22nd.—"Dust Explosions," Mr. J. D. Morgan.
December 30th.—Annual meeting.
January 24th, 1930.—Presidential address
February 28th.—"Electric Propulsion of Ships," Mr. W. J. Belsey.
March 14th.—Annual dinner.
March 28th.—"The Principles Underlying Television," Mr. J. B. Kramer.
April 25th.—"Pulverised Fuel," Mr. F. Forrest.

The Electrical Power Engineers' Association.

The Manchester Section of the E.P.E.A. is holding a social evening and dance at the Cheetham Town Hall on Saturday, October 12th. Tickets (2s. 6d. each) can be obtained from the Manchester office of the Association, Mr. Killeen, 269, Rochdale Road, Bury, or from members of the Sectional Committee.

Gyro Compass Invention Awards.

The Royal Commission on Awards to Inventors has published its decision in the matter of the Harrison & Rawlings liquid level control as applied to the Sperry gyro compass. The claimants were Sir James B. Henderson, D.Sc., Mr. S. G. Brown, F.R.S., Mr. A. L. Rawlings, Ph.D., and Mr. E. Kilburn Scott. The Commission awards Sir James Henderson £1,000 in respect of his claim for the floating ballastic and modified ballistic devices used in the solid bail type of Sperry gyro compass. As regards a second claim by Sir James, this was considered in conjunction with the claims of Mr. Brown and Dr. Rawlings. The Commission is satisfied that the use in substitution for the solid bail of a liquid level to obtain the necessary gravitational control of the compass originated partly from an examination of the compass submitted to the Compass Department by Mr. Brown, and partly from the suggestions made to the Admiralty by Sir James Henderson. The device actually adopted by the Admiralty was developed by Dr. Rawlings and another officer of the Compass Department, but as Dr. Rawlings had already received a grant and permission to dispose of the commercial rights of the device, and in view of his position in the Compass Department at the time, no award is recommended. It is proposed that Sir James Henderson and Mr. Brown should be awarded £5,000 each to cover all past, present, and future use of the compass. It is considered that the device put forward by Mr. Kilburn Scott contributed nothing to the compass in question, and no recommendation is made.

According to the *Brown Marine Gazette*, Mr. S. G. Brown declines to accept the award, as he claims to have invented the principle of the liquid level control independently and without assistance. He also considers that the amount awarded is altogether inadequate. He states that by acquainting the Admiralty of his principle he has suffered serious financial loss.

Ljungström Turbines.

Although the largest Ljungström steam turbine to run at a speed of 3,000 r.p.m. so far constructed is that recently completed for the power station at Leghorn, Italy, of the Società Ligure Toscana di Elettricita, the Svenska Turbinfabricks Aktiebolag Ljungström, of Stockholm, is now constructing a 27,000-kW turbo-generator set to run at that speed and is engaged on the design of sets of 30,000 and 40,000 kW capacity.

Traffic Control Signals.

The Ministry of Transport has issued a memorandum on traffic control by light signals, based on experience in America and other countries where such signals have been in use for many years. It has been drawn up after consultation with a conference of chief officers of police representing most of the cities and towns in this country wherein traffic light signals have been brought into operation. It is desirable, says the memorandum, that the signals in use in different parts of the country, their operation and siting, should be as nearly as may be, uniform. An increase in the safety of the streets for vehicles and pedestrians and easier and more regular flow of traffic, with consequent reduction of congestion and delay, can be secured by the use of automatic traffic signals, but the unnecessary and indiscriminate installation of such signals is to be deprecated. For the best results the traffic should be as nearly uniform as possible. Where there is a high percentage of horse-drawn vehicles it may be difficult to secure effective operation, and in such cases signals should be installed, if at all, only after careful investigation. It is recommended that three colours should be displayed vertically at each signal. The relative positions of the colours should be:—At the top, red; in the middle, amber; at the bottom, green. The purpose of the amber light is to give warning to drivers and pedestrians of the impending change from red to green. Red means "stop"; red and amber together mean "prepare to start when green is shown"; and green gives permission to move. The red lens should bear the word "stop" and the green one the word "go." White lines should be laid on the roadway to indicate the points at which vehicles are to stop when red is shown. The use of a bell to sound at the changes in the colours of the lights may be of service where the traffic is dense and includes a large proportion of large and high vehicles, such as double-deck omnibuses, and where there is therefore a possibility of one or more of the signals not being observed. The cycle length of the signals is an important matter. In general, short cycles are to be preferred to long ones, and for the control of ordinary traffic a cycle length of from 40 to 80 seconds is recommended; cycles of this length enable the maximum flow of traffic to be maintained. Pedestrians should be encouraged to cross the carriage-way under the care of the signals and at the points where such signals are erected, and at none other.

The Opposition to 132-kV Lines on the South Downs.

In a statement published in the *Daily Telegraph* of October 1st, the opposition to the proposed 132-kV lines on the South Downs is criticised as follows:—

The Central Board has paid special attention to the preservation of local amenities in the Lake District and the South Downs, and it has had the assistance of leading architects and authorities on landscape design. The Board was under obligation to bring electricity to the most remote districts in the country, and it has been impossible to avoid the erection of transmission lines in the Lake District and over the South Downs, the only alternative in the latter case being the complete omission of the South Coast towns from the national scheme. The Central Board has carried out lengthy negotiations in the Lake District and the South Downs with local authorities, county councils, associations representing special interests, societies for the preservation of rural beauty and other local amenities, but a point has now been reached at which no further concession can be made if the national scheme is to function at all. These negotiations and conferences have already occupied the greater part of this year, and they have encouraged innumerable parties of local authorities and local interests in their determination to carry out a policy of complete obstruction. It is only necessary to study developments in world-famous beauty spots on the Continent to discover that overhead main transmission can be in itself a thing of beauty, and can be designed to fit in with the most magnificent landscape.

The result of the delay incurred during such conferences must be serious, both for those great industries that are dependent on cheap power for improvement in their competitive efficiency, and for those industries which are already engaged in carrying out contracts in connection with the national scheme. The opposition, therefore, has got beyond the stage at which the desire to preserve local amenities is the one motive. It runs the risk of holding up the national scheme indefinitely and of increasing unemployment. It is surely time that an investigation were held, not merely into the origin of such demands and complaints, but also into the constitution and functions of the bodies and even of the individuals moving behind the opposition.

Owing to technical conditions, the cost of underground cables is not less than ten times that of overhead, and in some cases as much as thirty times; the resultant cost to the country, measured in terms of new capital, would be colossal, and the *régime* of cheap power would be indefinitely postponed.

The Batti-Wallahs' Society.

The first Batti-Wallahs' Society luncheon of the 1929-30 session was held at the Hotel Cecil on Tuesday last. Mr. George Balfour, M.P., was the principal guest, and delivered a brief address upon the position of the electricity supply industry of this country. He refused to acknowledge that Great Britain lagged behind the United States in electrical development, and maintained that it was absolutely unjust to compare two countries in which conditions were so widely different. In the latter part of last century we led the world in electricity supply, but we were already more "civilised" than the United States, and there was less scope for development. Again, electricity had to compete with an efficient and well-established gas industry, whereas large parts of the United States were virgin soil. In the earlier part of this century development was retarded by the cheapness of coal for steam raising. Electricity could not compete with manufacturers' small steam plant. When the war broke out practically every supply undertaking in the country had out inquiries for turbine plant, and the war held up development in that direction. By capturing the remunerative populous centres, the municipalities had robbed the large power companies of the means of building up economic systems with mains radiating into rural districts. Dealing with the legislation which had been concerned with the industry, Mr. Balfour said that the curious ideas regarding national reconstruction had culminated in the 1919 Electricity (Supply) Act. He and his friends had strenuously opposed

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that measure and had managed to kill the most vicious principles which it contained as a Bill. He stressed the fact that a cheap and abundant supply of electricity was not to be obtained by reducing production costs. It was the cost of distribution and the load factor which mainly determined the price; local rates added a great deal to the cost. The speaker said that there was a great deal of misapprehension regarding electricity prices, and he asked the members of the Society to go forth as missionaries to dispel the existing ignorance and thus render the industry a good service. Mr. Balfour also made reference to the Scottish hydro-electric schemes with which he was concerned, and particularly mentioned the 15½-mile tunnel that had been bored in connection with the Lochaber scheme, which he described as one of the greatest pieces of modern engineering.

The Professional Classes Aid Council.

The annual report of the Council for the year ended April 30th last states that there was a further increase in the number of applications for relief, the total being 920, as compared with 780 in 1928. Financial assistance was given to 183 families, and 362 inquirers were advised where to apply for help, in addition to many whose needs did not bring them within the scope of the Council. A gift of £650 was received from former pupils of Halliwick School, which will be used to give pensions or grants to distressed gentlwomen. The amount spent on education was £2,589, and 71 children were assisted. Training has been assisted in 29 cases, £582 being spent in this way, in addition to £204 in maintenance grants given during training.

The total income was £10,341, and the expenditure £8,818, leaving a balance of £1,523. The address of the hon. treasurer (Hon. George Colville) is 251, Brompton Road, S.W.3.

The Shannon Scheme.

In the area of the Irish Free State to which electricity from the Shannon hydro-electric scheme will be supplied, the equivalent of from 65 to 80 million kWh per annum is at present being used. In making this statment in a recent address to the Cork Rotary Club, Dr. T. A. McLaughlin, managing director of the Electricity Supply Board, said that the figure should settle once and for all the assertion that the Shannon would provide more electricity than the country could use. The consumption of electricity in the Free State in 1928 was 67 million kWh, and the figure on which the experts based the economy of the Shannon scheme was 110 million kWh. From the figures quoted it was quite obvious that the market possibilities far exceeded 110 million kWh.

Institution Notes.

The Institute of Metals.

Winter Session Activities.—The Institute of Metals has just issued its programme for the coming session. This includes over 40 meetings to be held in metallurgical centres throughout England, Scotland and Wales. The programmes of the various local sections have been drawn up to meet the needs of local industries. The subjects dealt with are of an essentially practical character, and include papers on "Metals in Aircraft Construction"; "Metal Melting by Electricity"; "Chromium Plating"; "Some Difficulties in Aluminium Alloy Founding and Some Remedies"; "Electric Heat-Treatment Furnaces"; and "The Effect of Some Impurities in Copper." Copies of the programmes can be obtained on application to the Secretary, Mr. G. Shaw Scott, M.Sc., 36, Victoria Street, London, S.W.1.

Institution of Electrical Engineers.

Informal Meetings.—The following is the programme of discussions at informal meetings during the new session:—

October 28.—"Systematic Research by Industrial Undertakings" (opened by the President, Colonel Sir T. F. Purves, O.B.E.).

November 4th.—"Paris and the Pyrenees: Notes on some of the Technical Features of the I.E.E. 1929 Visit" (opened by Mr. R. Borlase Matthews).

November 11th.—"Temporary Expedients in Engineering" (opened by Mr. W. E. Highfield).

November 25th.—"Wooden Poles for Overhead Transmission Lines and their Preservation" (opened by Mr. C. Wade).

December 9th.—"To Earth or not to Earth" (opened by Mr. W. R. Rawlings and Mr. T. C. Gilbert).

1930.

January 13th.—"Efficiency" (opened by Mr. A. Morgan).

January 27th.—"High Tension Distribution" (opened by Mr. G. V. Twiss).

February 3rd.—"Maintenance of Telephone Plant" (opened by Mr. H. G. S. Peck).

March 3rd.—"Push-Button Control" (opened by Mr. J. J. Fisher).

March 17th.—"High Tension Sub-station Control Gear" (opened by Mr. A. F. Harmer).

March 31st.—"Loud-speakers" (opened by Captain P. P. Eckersley).

April 14th.—"Telephone Exchange Practice in Germany and Scandinavia" (opened by Mr. A. B. Eason).

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. Edward Ernest Hoadley, borough electrical engineer at Maidstone, was married at St. Paul's Church, Maidstone, on September 17th, to Miss Helena Nora Smith, youngest daughter of Mr. W. Raymond Smith, of Springfield Avenue, Maidstone. The presents included a silver tea pot from the Corporation Electricity Committee, and a silver sugar bowl and cream jug to match from the staff of the Electricity Supply Department.

Mr. W. Ibeson, charge engineer, at the Longroyd Bridge electricity works, Huddersfield, has secured a position at the Widnes Technical Institute, and the Town Council has appointed Mr. E. B. Haigh as his successor.

According to *Modern Transport*, Mr. T. B. Goodyer, O.B.E., who recently resigned from the managership of Croydon Corporation tramways, has been appointed municipal sales manager of Tilling-Stevens Motors, Ltd., Maidstone.

Croydon Corporation Tramways Committee recommends that Mr. G. V. Stanley, acting tramway manager, be now appointed tramway manager at a salary of £600 per annum.

It is reported that Mr. J. B. Parker, general manager and engineer of the Tees-side Railless Traction Board, has been appointed general manager to the Aldershot and District Traction Co. at £1,200 a year.

Mr. B. A. Martin Cooper, for six years mains superintendent at Blackburn electricity works, has been appointed chief assistant engineer at Worcester under Mr. C. M. Shaw, M.I.E.E. Mr. Cooper received his training at the City and Guilds Engineering College at Kensington, and later he was with the Bournemouth Corporation tramways and Bournemouth & Poole Electric Supply Co. He has also had experience with the Newcastle Electric Supply Co., the Yorkshire Electric Power Co., and Messrs. Johnson & Phillips, Ltd.

The Electricity Committee of the Newark Town Council, on September 24th, considered 158 applications for the post of borough electrical engineer, and selected Mr. William Brown, B.Sc., A.M.I.E.E., mains superintendent of the Borough of Morecambe and Heysham, and Mr. Robert E. Liversley, B.Sc., A.M.I.E.E., chief electrical assistant, Aylesbury Corporation, to be interviewed by the committee, and the full Council later. The salary is £400 per annum, rising by £25 yearly to £500.

Mr. C. C. Rattey, M.I.E.E., chairman of the Alton Battery Co., Ltd., left in the *Berengaria* on September 28th *en route* for the United States, Canada and the Far East. He will return about the end of February next *via* the Straits Settlements, Ceylon and India. The Alton Battery Co., Ltd., intends to establish branch offices and depôts wherever trading conditions warrant. Mr. W. R. Montgomery, a director, and the manager of the company, will be in control of its interests during Mr. Rattey's absence.

Mr. J. R. Barrett has joined the sales staff of the Horstmann Gear Co., Ltd., and will represent that company in the Midlands.

Alderman H. R. Nuttall, Chairman of Burnley Electricity Committee for many years, has been selected as Mayor for next year.

Barking U.D.C. Electricity Committee has appointed Mr. A. B. Catling, mains superintendent, Eccles, as mains superintendent, and Mr. P. R. Stracey, sub-station attendant, Gosport and Fareham Tramway Co., as sub-station attendant.

Mr. S. B. Donkin has accepted the office of President of the Association of Supervising Electrical Engineers for a further term. He will deliver his presidential address on October 15th.

Mr. H. W. Edwards, who was engineer to the Oswestry Electricity Company's undertaking, has been appointed borough electrical engineer to the Oswestry Town Council, which has decided to take over the company.

Mr. C. McKinlay recently left Metro-Vick Supplies to take up an appointment as representative for Messrs. Lane and Girvan, Ltd., for the sale of "Caledonia" electric heating and cooking appliances in England, Wales, and Ireland. On September 20th an interesting ceremony took place at the general offices (Charing Cross Road) of Metro-Vick Supplies, when Mr. McKinlay was presented by Mr. P. F. Crinks (general manager), on behalf of Mr. McKinlay's friends in the organisation, with an inscribed gold watch.

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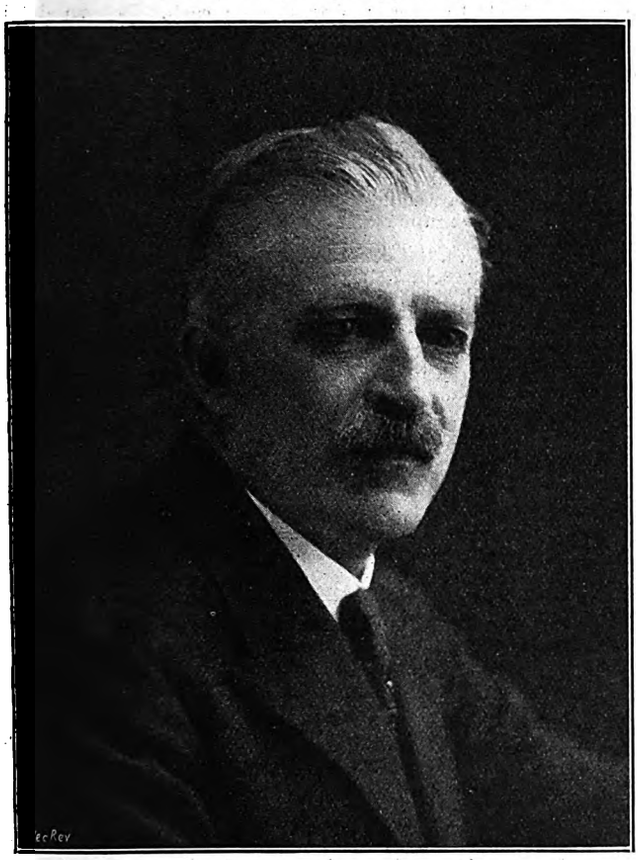
We reproduce herewith a portrait of Mr. R. G. Ward, who has just relinquished the position of chairman of the Sheffield Sub-Centre of the Institution of Electrical Engineers. Mr. Ward was educated at Towcester and at the Cardiff University and received his early electrical and mechanical training with the Cardiff Dowlas Co. From there he went to Messrs. John Brown & Co., Ltd., Sheffield, as electrical engineer and is now



Elliott & Fry] *[London.*

Mr. R. G. Ward,

Immediate Past-Chairman of the Sheffield Sub-Centre of the I.E.E.

chief electrical engineer to that company. Mr. Ward represented the I.E.E. at the Royal Sanitary Institution held in Sheffield during July.

As reported last week, Mr. R. Birkett has retired from the position of borough electrical engineer of Southend. In consequence of his continued ill-health, Mr. Birkett had asked the Electric Lighting Committee to consider the question of his retirement. This was done, and it was reported that he had done 32 years' service (24 years in Southend), which counted for superannuation purposes. The committee was of opinion that the allowance should be calculated at the rate of one-eightieth for each year of service instead of one-one hundred-and-twentieth, which was the minimum allowed by statute. The effect of this would be to make the allowance £600 per annum, £400 of which would fall upon the Superannuation Fund and £200 upon the electricity undertaking. These recommendations were carried without comment.

Mr. F. E. Smith, C.B., C.B.E., D.Sc., F.R.S., Director of Scientific Research at the Admiralty, has been appointed by His Majesty the King in Council to be Secretary to the Committee of the Privy Council for Scientific and Industrial Research, with effect from October 1st, 1929, on the resignation of Mr. H. T. Tizard, C.B., F.R.S.

The members of the Blackpool Athenæum Club are combining to make a gift to their president, Mr. Charles Furness, Blackpool's electrical engineer and tramway manager, whose marriage will take place shortly. Mr. Furness was a founder of the club, and has been the driving force behind its activities ever since.

The Guildford Town Council has appointed Mr. W. F. May, assistant mains superintendent, as mains superintendent at a salary of £250 per annum, rising to £300.

Mr. T. W. Douglas, assistant superintendent of the Telegraph Department at Cork, has retired after a period of 45 years' service.

At a recent meeting of the Barking Town U.D.C. it was reported that Mr. Holmes, the electrical engineer, was still absent owing to illness, and that Mr. W. E. Kidner, acting electrical engineer, was in charge.

Mr. F. W. Purse reminds us that he left West Ham on October 1st. His address is now the London and Home Counties Joint Electricity Authority, 5, Millbank, S.W.1.

Mr. S. A. Knight, B.Sc., A.C.G.I., has left the Metropolitan-Vickers Electrical Co., Ltd., to join the Harland Engineering Co., Ltd., Alloa, and is shortly proceeding to Calcutta to take charge of the Harland interests in India. His Calcutta address will be P.O. Box 189.

Manchester Corporation Electricity Committee has appointed Mr. S. A. Russell, A.M.I.E.E. as resident engineer, Barton power station.

Croydon Electricity Committee recommends that Mr. Hosking, now assistant power station superintendent, be designated Engineering Assistant to the Borough Electrical Engineer, and that Mr. Hockley, the senior charge engineer, be appointed generating engineer.

Obituary.—Mrs. Bragg.—The whole of our readers will, we feel sure, associate themselves with us in an expression of deep sympathy with Sir William Bragg on the death of his wife, which occurred on Sunday last.

Mr. G. J. Alderman.—The death took place on September 25th, at the age of 73 years, of Mr. George James Alderman, who was for many years in business as an electrician in Minster Street, Winchester, of which city he was a native. Since his retirement about five years ago the business has been conducted by Shiner & Cooper.

Wills.—The late Mr. Robert Grundy Brooke, managing director of Holden & Brooke, Ltd., left £57,408 net and £60,379 gross personalty.

Lord Montagu of Beaulieu, chairman of Edison Accumulators, Ltd., and other companies, left unsettled estate of £56,224 gross and £47,846 net.

Mr. C. T. Briscoe, of Blackpool (chairman of C. T. Briscoe and Sons), left £4,275 gross and £1,272 net personalty.

Mr. W. S. Toplis, of Marylebone, electrical engineer, left £14,276 net and £14,841 gross personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Fred. W. Wood, Ltd.—Private company. Registered September 24th. Capital, £1,500 in £1 shares. Objects:—To carry on the business of wireless engineers, manufacturers and dealers, gramophone manufacturers and dealers, dealers in apparatus for reception and transmission of pictures, and television, &c. The first directors are:—F. W. Wood, 122, Farebrother Street, Grimsby, wireless engineer; S. F. Jennison, 4, Dudley Street, Grimsby, fish merchant; D. C. Lazenby, 9, Grosvenor Crescent, Grimsby, C.A.; A. P. Pearson, 46, Anston Avenue, Worksop, stores manager. Secretary: D. C. Lazenby. Registered office: 24a, Bull Ring, Grimsby.

Portables, Ltd.—Private company. Registered September 25th. Capital, £100 in 1s. shares. Objects:—To carry on the business of manufacturers, importers and exporters of, and dealers in all kinds of portable and other gramophone, wireless, kinematograph, electrical, mechanical, musical, talking and sound producing, receiving, transmitting, and recording instruments, &c. The subscribers (each with 100 shares) are: L. F. Chapman, 11, Queen Victoria Street, E.C.4, merchant tailor; W. F. Crol, 1, Museum Street, W.C.1, company director; W. E. Adolph, 5, Brickhill Lane, E.C.4, wine merchant. The first directors are to be appointed by the subscribers. Solicitor: H. P. Crowe, 3, Staple Inn, Holborn, W.C.

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Leroy & Richardson, Ltd.—Private company. Registered September 26th. Capital, £3,500 in £1 shares. Objects:—To carry on business as wireless and electrical engineers, manufacturers, contractors and repairers, dealers in wireless, electrical and photographic instruments and fittings, loud-speakers, valves, accumulators, television instruments and apparatus, &c. The directors are:—L. Leroy, "The Gable End" Library, Seaford, music and book seller; J. S. Richardson, 170, High Street, Lewes, radio engineer. Secretary: J. S. Richardson. Registered office: 170, High Street, Lewes.

Bridges-Bower, Ltd.—Private company. Registered September 24th. Capital, £500 in £1 shares. Objects:—To carry on the business of radio and electrical engineers, manufacturers of, and dealers in electrical apparatus, machines, instruments, accessories and goods, &c. The subscribers (each with one share) are:—E. E. W. de Becker, engineer, and Dorothy King, 16, Old Quebec Street, W.1. E. E. W. de Becker is the first permanent director. Registered office: 77, New Oxford Street, W.C.1.

Norwood Radio, Ltd.—Private company. Registered September 25th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of manufacturers of, and dealers in wireless and electrical apparatus and accessories, musical instruments and goods, &c. The directors are:—P. S. Matthewman, 5, Grange Gardens, South Norwood Hill, S.E. (director, Matthewman & Hagland, Ltd.); F. G. W. Chidsey, 24, Knights Hill, West Norwood, S.E.27. Registered office: 28, Budge Row, E.C.4.

Super Relay Service, Ltd.—Private company. Registered September 26th. Capital, £250 in 5s. shares. Objects:—To construct and maintain wireless signal stations and all other stations for the reception and distribution of radio signals or waves, and to carry on the business of consulting wireless experts, manufacturers of, and dealers in all kinds of wireless appliances, &c. The directors are:—W. T. Kempton, Forehill, Ely; R. G. Houghton, Market Place, Ely. Registered office: 2a, Forehill, Ely.

Kew Engineering Co., Ltd.—Private company. Registered September 20th. Capital, £15,000 in £1 shares. Objects:—To adopt an agreement with the Cowey Engineering Co., Ltd., and L. E. Cowey, and to carry on the business of manufacturers and constructors of, and dealers in substances, articles and apparatus for use in connection with the transmission, emission or reception of sound, pictures, light, heat and power, &c. The subscribers (each with one share) are:—J. G. A. Bickford, 73, Southwold Mansions, Maida Vale, W.9; R. D. Pond, 14, Queen Victoria Street, E.C.4, clerks. The first directors are to be appointed by the subscribers. Solicitors: Gilbert, Clarke & Gilbert, 14, Queen Victoria Street, E.C.4.

Rose & Partridge, Ltd.—Private company. Registered September 23rd. Capital, £1,000 in £1 shares. Objects:—To acquire (1) the business of electrical engineers and dealers in electrical novelties and merchants now carried on by A. H. Rose at 6, South Street, E.C., as Rose Bros.; and (2) the business of an electrical engineer and dealer in electrical novelties now carried on by S. Partridge at 43a, Barbican, E.C., as "S. Partridge," and to carry on the business of manufacturers of, and dealers in electric batteries, lamps, torches, accumulators, instruments and novelties, wireless installations, loud-speakers, &c. The directors are:—A. H. Rose (chairman), 6, South Street, E.C.2; S. Partridge (managing director), 43a, Barbican, E.C.1. Registered office: 6, South Street, E.C.2.

Scottish Mica Co., Ltd.—Private company. Registered in Edinburgh on September 20th. Capital, £100 in £1 shares. Objects:—To carry on the business of mica and mineral importers, merchants, agents, &c. The subscribers (each with one share) are:—J. H. Wallace, writer; E. D. Leggett, clerk, both of 150, St. Vincent Street, Glasgow. Registered office: 209, West George Street, Glasgow, C.2.

Honeycomb Batteries, Ltd.—Private company. Registered September 27th. Capital, £100 in £1 shares. Objects: To carry on the business of electrical engineers, electricians, manufacturers of and dealers in electric cells, &c. The subscribers (each with one share) are: R. H. Brown, 10, Coverdale Road, W.12, accumulator specialist; P. H. A. Martin, 12, Annandale Road, Chiswick, W.4, storage battery engineer. The directors are: R. H. Brown and others to be appointed by the subscribers.

R. G. Heaton & Co., Ltd.—Private company. Registered September 28th. Capital, £1,000 in £1 shares. Objects: To acquire the business of an electrical and radio engineer heretofore carried on by R. G. Heaton at 108, Alexandra Road, Moss Side, Manchester. The directors are: R. G. Heaton, 108, Alexandra Road, Moss Side, Manchester; B. Heaton, 39, King Edward Road, Moseley, Birmingham; Mrs. Ivy B. M. Choularton, 28, Norton Street, Old Trafford, Manchester (all permanent, subject to each holding 10 shares). The said R. G. Heaton shall be permanent managing director so long as he holds 100 shares, with £250 per annum as remuneration. Registered office: 108, Alexandra Road, Moss Side, Manchester.

Official Returns of Electrical Companies.

Yorkshire Traction Co., Ltd. (formerly Barnsley and District Traction Co., Ltd.).—Capital, £200,000 in 50,000 preference and 150,000 ordinary shares of £1 each. Return dated May 9th, 1929. 22,350 preference and 109,505 ordinary shares taken up. £109,820 paid on 22,350 preference and 87,470 ordinary shares. £22,035 considered as paid on 22,035 ordinary shares. Mortgages and charges: £19,928 4½ per cent. debenture stock; £29,000 second debentures issued to bankers as collateral security. Returns of allotments, made up to July 25th, 1929, show a further 38,495 ordinary shares allotted, payable in cash, and fully called up; and 2,000 preference and 2,000 ordinary shares allotted as fully paid as part payment for purchase of omnibuses.

Vickers, Ltd.—Capital, £26,500,000 in 54,000,000 ordinary shares of 6s. 8d. each, 7,000,000 5 per cent. cumulative preference shares, and 750,000 5 per cent. preference shares of £1 each and £750,000 preferred 5 per cent. stock. Return dated April 8th, 1929. 12,315,483 ordinary, 6,863,807 cumulative preference, and 750,000 preference shares and £750,000 preferred stock issued and fully paid up. Mortgages and charges: £1,250,000 5 per cent. first mortgage debenture stock; £2,000,000 5½ per cent. debenture stock, and £55,388 on houses and land at Barrow.

China and Japan Telephone and Electric Co., Ltd.—Capital, £75,000 in £1 shares. Return dated May 28th, 1929. 39,761 shares taken up. £25,000 paid. £14,761 considered as paid. Mortgages and charges, nil.

W. H. Allen, Sons & Co., Ltd.—Capital, £500,000 in £1 shares. Return dated July 15th, 1929. 408,750 shares taken up. £58,757 paid. £349,993 considered as paid. Mortgages and charges, £149,000.

Ilfracombe Electric Light and Power Co., Ltd.—Capital, £50,000 in £5 shares. Return dated June 11th, 1929. 7,000 shares taken up. £35,000 paid. Mortgages and charges, nil.

Newmarket Electric Light Co., Ltd.—Capital, £30,000 in £10 shares. Return dated April 5th, 1929. 2,656 shares taken up. £26,560 paid. Mortgages and charges, £14,200.

Hampshire Light Railways (Electric) Co., Ltd.—Capital, £1,000 in £10 shares. Return dated May 29th, 1929. All shares taken up. £1,000 paid. Mortgages and charges, nil.

Willans & Robinson, Ltd.—Capital, £173,165 5s. in £30,000 "A" preference stock and £141,665 5s. "B" preference stock, and 30,000 ordinary shares of 1s. each. Return dated April 29th, 1929. All shares and stock taken up. £142,431 10s. paid on £30,000 "A" stock, £110,931 10s. "B" stock, and 30,000 ordinary shares. £30,733 15s. considered as paid on £30,733 15s. "B" stock. Mortgages and charges, £116,740.

Llangollen and District Electric Light and Power Co., Ltd.—Satisfaction in full on September 14th, 1929, of debenture dated March 7th, 1911, securing £300.

Norfolk Engineering Co., Ltd.—F. Heywood, 16, Cambridge Street, Sheffield, ceased to act as receiver and manager on September 20th, 1929.

Cark & District Electricity Co., Ltd.—Particulars filed of £1,000 debentures authorised August 13th, 1929, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

La Plata Electric Tramways Co., Ltd.—Capital, £450,000 in 200,000 preference and 250,000 ordinary shares of £1 each. Return dated May 22nd, 1929. All shares taken up. £170,007 paid on 170,007 preference shares. £279,993 considered as paid on 29,993 preference and 250,000 ordinary shares. Mortgages and charges, £90,200.

Summit Electrical Co., Ltd.—Capital, £100 in £1 shares. Return dated March 18th (filed July 26th), 1929. All shares taken up. £100 paid. Mortgages and charges, nil.

City Notes.

Folkestone Electricity Supply Co., Ltd.

It was announced this week that the County of London Electric Supply Co., Ltd., had made an offer to purchase the company's ordinary share capital, amounting to £175,000.

The directors stated that the terms of the offer would be contained in a circular which would be issued to shareholders, and the acceptance of the offer would be recommended.

Babcock & Wilcox, Ltd.

The directors recommend a dividend of 7 per cent., free of tax, on the ordinary capital in respect of the half-year ended June 30th.

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Stock Exchange Notices.

Dealings in the following have been allowed by the Committee under Rule 159:—

Crompton Parkinson, Ltd.—200,000 new ordinary shares of 5s. each, issued at 10s. per share, fully paid, Nos. 450,001 to 650,000.

Underground Electric Railways of London.—5,741 ordinary shares of £1 each, fully paid, Nos. 7,224,312 to 7,230,052.

The undermentioned have been ordered to be officially quoted:—

Underground Electric Railways Co. of London, Ltd.—1,865 ordinary shares of £1 each fully-paid, Nos. 7,222,447 to 7,224,311.

The Cable and Wireless Merger.

Cables and Wireless, Ltd., announces that the certificates of "assents" deposited at the close of business on September 25th were as follows:—Eastern Telegraph Co., Ltd., 97.86 per cent.; Eastern Extension, Australasia and China Telegraph Co., Ltd., 98.02 per cent.; Western Telegraph Co., Ltd., 98.15 per cent.; and Marconi's Wireless Telegraph Co., Ltd., 92.14 per cent. The 92.14 per cent. of the shares in Marconi's Wireless Telegraph Co. assented represents 89.5 of its nominal issued capital. Assents are still coming in. The company points out that to secure the benefit provided under the Act for the relief from capital duty, amounting to approximately £40,000, it is necessary to obtain assents for 90 per cent. of the issued capital. For this purpose, only an additional £10,962 in Marconi shares is now required to be assented.

Official Notice *re* Companies.

The names of the undermentioned companies will be struck off the Register at the expiration of three months, unless cause is shown to the contrary:—

B. Morris (Electrical Radio), Ltd.
Deansgate Electro Radio (Manchester), Ltd.
Dur-a Electric Lamps, Ltd.
Electric Bulk, Ltd.
Everose Electrical Co., Ltd.
Garker Electrical Manufacturing Co., Ltd.
Heath's Auto Electrical Co., Ltd.
P. F. Brittain, Ltd.

Philips' Glowlamp Works.

The *Financial Times* says that the issue is announced of £1,300,000 ordinary shares at 250 per cent. and £440,000 cumulative preference shares at 130 per cent. in Philips' Glowlamp Works to holders in the proportion of three old to one new. The new shares are entitled to a quarter of the 1929 dividend. This will bring the capital up to £5,200,000 ordinary and £1,770,000 cumulative preference shares.

Falkirk Iron Co., Ltd.

After meeting debenture interest and interest on employés' share deposits, the profit for the year ended March 31st last was £972 (against £16,701). A balance of £32,931 brought forward is added, and it is proposed to carry forward the whole amount (£33,904). Last year a dividend of 6 per cent. was paid.

Ransome & Marles Bearing Co., Ltd.

From the profit of £66,788 for the year ended June 30th last the directors propose to pay a dividend of 8 per cent., less tax, on the ordinary shares, and transfer £7,577 to reserve, leaving £27,211 to be carried forward.

Associated Fire Alarms, Ltd.

A dividend of 8 per cent. is recommended on the ordinary shares for the year ended June 30th last. A similar dividend was paid for 1927-28.

Electrical Finance and Securities Co., Ltd.

An interim dividend of 4 per cent. has been declared on the ordinary shares (as last year).

West London and Provincial Electric and General Trust, Ltd.

An interim dividend of 4½ per cent. has been declared.

German Companies.

The *United Electrotechnical Works Co.* (*Busch & Jaeger*), Ludenscheid, proposes to pay a dividend of 5 per cent, out of net profits of 200,000 marks for 1928-29.

The *Rheydt Cable Works Co.*, Rheydt, states that activity in 1928-29 was satisfactory. The net profits increased from 1,020,000 marks in 1926-7 to 1,060,000 marks last year, the dividend remaining at 12 per cent.

The *Electricity Company* (*late Lahmeyer & Co.*), Frankfort-on-Main, records an increase in net profits from 2,032,000 marks to 2,440,000 marks in 1928-29. The dividend is raised from 10 to 12 per cent.

The *German Electricity Works Co.* (*Garbe, Lahmeyer and Co.*), Aix-la-Chapelle, reports that the gross profit increased from 2,419,000 marks in 1926-27 to 2,657,000 marks last year, while the net profit rose from 262,000 to 284,000 marks. After making various appropriations, a balance of 34,000 marks has been carried forward.

Stocks and Shares.

TUESDAY EVENING.

The long-threatened rise in the Bank Rate took place on the Thursday in last week, when the 5½ per cent. that had been in force since February was raised by 1 per cent. The immediate effect was comparatively innocuous, so widely had the possibility been discounted in advance. A heavy tendency spread throughout gilt-edged securities, but the falls were trifling, and had it not been for the fear that a still further advance may be necessary in order to check the drain of gold and to re-establish the exchanges, it is possible that no unfavourable effects would have been produced upon prices. As, however, the fear does undoubtedly persist in regard to a yet further rise in the Rate, this has the effect of weighing down quotations for investment stocks and shares, and of accentuating the depression caused in a good many markets by the collapse of what has come to be known as the Hatry group.

This collapse has had effects that stretch far beyond the immediate circle of companies involved. The action of the Stock Exchange Committee in withdrawing permission to deal in the shares and stock of the Hatry group came immediately after heavy falls in the prices of those particular issues. The Stock Exchange Committee took prompt action, and postponed settlement of the bargains that had been done for the end-September account until October 24th. The uncertainty which remains acts, however, as a strong restraint upon confidence and enterprise. Nobody quite knows who will be hit by the débâcle. It is well known that strong institutions may prove to be amongst the heaviest losers; and, if so, the burden will fall upon shoulders able to carry it. Other and smaller people can hardly hope, however, to escape. It remains to be seen to what extent the ramifications of the trouble will proceed. This uncertainty, combined as it was with the rise in the Bank Rate, led to prices of stock and shares all round the markets being weakened by the prevailing atmosphere.

Dollar Stocks.

Although heavy falls occurred in a great number of American industrial securities, the prices of shares in the utility Companies have been remarkably well held. It might have been supposed that speculative counters, such as Brazilian Tractions and Hydro-Electrics, would have been amongst the first to give way under the pressure of the difficulties, but in point of fact, Hydro-Electrics, though the price dipped to 82, rallied promptly to 83¼. After that it dived to 79½, leaving a fall, on the week, of 4½. International Holdings, which are still regarded as the stable companion of Hydro-Electrics, are lower at 10½. The American telephone group is surprisingly steady, considering the very substantial rise which has lately occurred in the prices of the stocks. American Telephone and Telegraph, at 302, shows a nominal fall of 8 points, of which, however, the dividend deducted from the price on September 27th accounts for a couple of points. International Telephones at 130 are 10 lower. The dividend was taken off in this case also, though the amount of ½ per cent. was negligible. Mexico Tramways at 56 are unchanged; Puebla Tramways rose 2½ to 20.

American Utilities.

In the power group, Shawinigan Water, at 106, is 2 up. Power Corporation of Canada, at 126½, has gained the fraction; Montreal Light, Heat & Power shares of no par value are 174½, showing a gain of no less than 16, not to mention the dividend of 4 points that was deducted from the price last Pay Day. Movements such as these do not suggest that the American buyers of Utility shares have taken serious fright at the monetary tightness on this side, or at the effects of the Hatry group collapse. Considerable sums of money, it may be mentioned without breaking confidence, have recently been put into American utilities by important British insurance companies, whose aim is similar to that of the Americans themselves; namely, capital appreciation rather than a desire to obtain good yield, for the time being.

British and American Views.

One of the reasons why British investors are reluctant to take a hand in the American market, and have, as a whole, declined to follow the bulls in New York, is the difference of angle of view adopted by our people and by the Americans. Clients on this side look to see what dividends a company is paying, and what is the yield to be obtained by a purchase of shares. If the return is something small, the client, as likely as not, will decline to have anything to do with it; hence the refusal of British investors to participate to any wide extent in the American market activity. On the other side of the water, the standpoint is that an investor must disregard the yield that shares offer at the present time; the essential thing to observe is the profit-earning capacity of a company. This can be seen in such shares as Metropolitan Electric, where, at the present price of 46s. 3d., the return is under 4 per cent. on the money, on the basis of the usual 9 per cent. dividend paid by the company. The British investor argues this yield is not enough; but the American, maintaing that in the company there resides room for expansion of profit-earning capacity, continues to

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buy the shares. There are many better illustrations which can be chosen, but Metropolitan Electric is one that comes randomly to mind.

The Folkestone Company Acquired.

Rumours lately current as to a possible purchase of the Folkestone Electric Lighting Company, crystallised into fact in the early part of this week. The news was contained in a letter, sent by hand to the Stock Exchange, from the County of London Electric Lighting Company, stating that the latter had bought the Folkestone Electric, the shareholders in which would be well advised not to part with (*sic*) their shares. The purchase is to be effected on the basis of an exchange of shares. Taking the price of County ordinary at 57s. 6d., the Folkestone shares will work out, roughly speaking, in the near neighbourhood of 70s., and proprietors will no doubt be very satisfied with the manner in which the negotiations have been concluded. The price of Folkestone, which stood at 50s. a week ago, has risen to 56s. 3d. County ordinary are, if anything, a little lower at 57s. 6d. sellers. The 6 per cent. preference shares, like those of the North Metropolitan Electric sixes, are easier at 22s. 6d., by reason of the rise in Bank Rate. North Metropolitan ordinary hold their previous gain, being firm at 57s. 3d., Metropolitan ordinary continue somewhat dull at 46s. 3d. Slight falls reduced Egham and Staines to 37s., and Northamptons to 47s. 9d. Midland Electric Power shares have lost 1/16th, at 35s. Bournemouth and Poole, at 64s. 6d., are 1s. 9d. lower. Shropshires fell back to a guinea.

The disposition of the market in electricity supply shares is heavy, and the situation derives no benefit from the rapid drawing-in of the daylight, or the fact that clocks go back an hour at two a.m. next Sunday morning. Much money has to be provided against claims due to the substantial depreciation incurred by reason of Bank Rate rise and the Hatry group fall. The liquidation is marked in stocks and shares that remain readily saleable, as electricity supply shares are; it is not every market which can find buyers of shares even at reduced prices. No better evidence can be produced of the confidence that electricity shares command, than the relative firmness, as compared with the weakness elsewhere, shown by the prices quoted in our own list.

Equipment and Manufacturing.

Still more striking, perhaps, is the fact that prices of various shares in the manufacturing division should have further advanced, after a considerable rise previously, in the face of all-round depression elsewhere. British Insulated ordinary regained the deducted dividend of 1s. per share, and added 1/16 as well, to their price. Enfields followed up their sharp advance with a fresh improvement of ½, this making the price 5⅛. British Aluminium, at 50s. 9d. ex dividend, are virtually unchanged. Henley's eased off to 6⅝. A fall of 5s. lowered Associated Electrical Industries to 37s. 6d., and General Electrics gave way to 52s. 6d. English Electric ordinary and preference fail to recover the losses sustained a week ago, and Crompton Parkinsons are flat at 20s.

Home Railway Weakness.

Further falls have taken place in the market for Home Railway stocks, the only issue to escape the general heaviness being Central London ordinary assented stock, which remained at 71. Underground income bonds have shed four points to 105, and the shares gave way to 22s. Metropolitans lost a point; Districts fell 10s. These falls, in view of the de-rating reliefs, which came into force on Tuesday of this week, are disappointing, and are due partly to the closing of stale bull accounts, partly to the need for raising money required to finance other obligations. Amongst traction issues, British Electric Tractions deferred ordinary, at 1,600, is 25 points lower, and the preferred ordinary stock shed 6½, falling to 121½.

Foreign Traction.

Anglo-Argentine Tramways first and second preference are flat at 3⅛. Remarkable fluctuations occurred in Brazilian Tractions, the price jumping to 77, on Monday evening, and subsiding to 72 in the street on the following night. The preferred shares are better at 240. Mexican Light and Power common shares rose 9 to 126½, and the 7 per cent. preferred, at 80½, are 4 up. British Columbia 5 per cent. preference, at 86½, has given way 2 points. San Paulo Electric 5 per cent. bonds fell to 86½, and Vancouver Power 4½ per cent. debenture to 76½. Atlas shares are lower at 27s.

Further Falls in Cable Stocks.

Cables and Wireless B ordinary stock, at 57½, is 5 points down on the week, and 42½ lower as compared with the price reached less than three months ago. The 7½ per cent. A ordinary stock is 2 down, at 82½, and the 5½ per cent. preference, quoted at 92½, is ex a quarter's dividend. The market has subsided into a condition of weakness, in which every sale, however small, exercises a disproportionate effect upon the prices. Marconi Marines have dropped to 2¾. The iron and steel section is dull, in sympathy with other industrial descriptions. A fall in rubber to 9¾d. per lb. served to accentuate the depression that had been previously ascribed to mild liquidation amongst some of the leading shares.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Approx. Dividend. 1927.	1928.	Price Oct. 1 1929.	Rise or fall	Yield p.c.
Bournemouth and Poole	1	15	15	64/6	—1/9	4 13 0
Brompton Ordinary	1	8½	8½	26/-	—	5 7 8
Charing Cross Ordinary	1	8½	8½	26/6	—	5 5 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8¾	8¾	25/-	—	5 12 0
City of London	1	10	10	32/-	—	4 7 6
do. do. 6% Pref....	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	36/3	—	... ...
County of London	1	7	10	57/6	—	8 9 9
do. do. 6% Pref....	1	6	6	22/6	—6d.	5 6 8
Edmundson's 7% Pref.	1	7	7	24/-	—	5 16 8
Elec. Supply Corporation	1	11	11	52/-xd	—	4 4 8
Kensington Ordinary	1	8	8	26/-	—	5 7 8
Lancs. Light and Power	1	7½	7½	28/-	—6d.	5 7 2
London Electric	1	8½	9	27/6	—	5 1 10
Metropolitan	1	9	9	46/3	—	3 17 8
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6½	6½	34/6	—	3 15 4
Mid. Elec. Power	1	15	8	35/-	—1/8	4 11 5
Newcastle-on-Tyne Ordinary ...	1	6	6	26/3xd	—	4 11 5
do. 7% Pref.	1	7	7	25/6xd	—	5 9 10
Notting Hill 6% Pref.	10	6	6	11	—	5 9 1
North Met. Elec. 6% Pref.	1	6	6	22/6	—6d.	5 6 8
St. James' and Pall Mall	1	8	8	26/6	—	5 5 8
Scottish Power	1	8	8	31/6	—	5 1 7
South London	1	8½	8½	26/6xd	—	5 5 8
Urban Ordinary	1	7	7	33/3	—	3 18 6
Westminster Ordinary	1	8½	8½	25/6	—	5 9 10
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	23/9xd	—6d.	6 6 4
Yorkshire Elec.	1	8	8	36/6	—	4 7 8

Home Rails.

Central London Ord. Assented ...	Stock	4	4	71	—	5 12 8
Metropolitan	"	8	8½	58½	—1	5 19 8
do. District	"	4	5	71½	—½	6 19 10
Underground Electric ...	£1	5	7	22/-	—1/-	6 7 8
do. do. Income ...	Bonds	6	6	105	—4	5 14 8

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	103	—	5 16 6
do. Def.	"	1½	1½	24½	—	6 4 5
Automatic Telephone	1	10	12½	37/6xd	—6d.	6 13 4
Cables & Wireless 5½ Pref.	Stock	—	—	92½xd	—	5 19 0
do. A 7½ Ord.	"	—	—	83½	—2	... ...
do. B Ord.	"	—	—	57½	—5	... ...
Globe Tel. and T. Ord.	10	10	10	25xd	—	*3 18 6
do. do. Pref.	10	6	6	10½xd	—	5 9 1
Great Northern Tel.	10	20	17½	31	—	5 13 0
Indo-European	25	10	10	47½	—	*5 5 3
Marconi-Marine	1	12½	15	2⅞	—⅛	5 9 2
Oriental Telephone Ord	1	12	12	3	—	... ...

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	8½	—3/16	8 16 0
do. do. 2nd Pref. ...	5	6	6	8½	—¼	9 12 0
do. do. 5% Deb. ...	Stock	5	5	75	—	6 13 4
British Electric Traction Def. Ord.	"	5	5	1600	—25	... ...
do. do. Pref. Ord.	"	8	8	121½	—6½	6 11 9
Brazil Traction	100	7	8	72	—	2 15 7
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	86½	—2	5 15 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	10/-	—	... ...
London United Tram Deb. ...	Stock	4	4	51½	—	7 15 4
Mexico Trams, 5% Bonds	—	5	5	75½	—	6 12 5
Mexican Light Common	100	Nil	Nil	126½	+9	... ...
do. 7% Pref.	100	7	7	80½	—4	8 8 8
do. 1st Bonds	—	5	5	78	—	6 12 5
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...

Manufacturing Companies.

Assoc. Elec. Ord.	1	6	—	1⅞	—⅛	3 4 0
Babcock & Wilcox	1	13	15	65/-	—	*4 12 4
British Aluminium Ord.	1	10	10	50/9xd	—	*3 18 9
British Elec. Transformer Pref. ...	1	7	7	18/-	—	... ...
British Insulated Ord.	1	15	15	4 1/16xd	+2/-	3 14 0
Brush Ord.	Stock	10	10	180	—	7 13 10
Callenders	1	15	15	4	—	3 15 0
do. 6½% Pref.	1	6½	6½	1½	—	5 4 0
Crompton Parkinson Ord.	5/-	—	—	1	—6/6	... ...
do. 8% Pref.	1	8	—	25/-xd	+3/8	6 2 5
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	7 1 2
do. 5% Deb.	Stock	5	5	84½	—	5 18 4
Electric Construction	1	7½	5½	15/-	—	7 6 8
Enfield Cable Ord.	1	20	20	5⅛	+⅛	3 18 0
English Electric	1	Nil	Nil	8/3	—	... ...
do. do. Pref. ...	1	8	Nil	8/9	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
do. Ord.	1	10	10	28	—3/16	3 16 2
Henley...	1	25	30	6⅝	—1/16	4 10 8
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	Nil	Nil	12/6	—	... ...
Johnson & Phillips	1	10	—	2	—	5 0 0
Siemens Ord.	1	7½	7½	28/9	—	5 4 4
Telegraph Construction	12	10	10	23	—	5 4 2

* Dividends paid free of Income Tax.

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Italian Foreign Electrical Trade.

Imports and Exports in 1927 and 1928.

THE following statement, showing the imports into and exports from Italy of electrical goods during 1928 has been complied from the recently-issued official trade statistics. The figures for 1927 are added for purposes of comparison and notes of any increases or decreases are made:—

Imports.

	1927. Quintals.	1928. Quintals.	Inc. or dec. Quintals.
Electric generators and motors—			
Total	22,000	26,400	+4,400
From Austria	900	500	− 400
,, Germany	7,500	9,600	+2,100
,, Great Britain ...	700	400	− 300
,, Switzerland	2,600	2,200	− 400
,, Hungary	2,000	3,100	+1,100
,, United States ...	1,900	900	−1,000
Static transformers—			
Total	4,500	3,400	−1,100
From Austria	200	100	− 100
,, Germany	2,000	1,000	−1,000
,, Germany (Reparation account)	500	10	− 490
,, United States ...	20	60	+ 40
Electricity meters—			
Total	3,400	2,800	− 600
From Germany	3,000	2,600	− 400
,, Switzerland	200	50	− 150
**Telegraph and telephone apparatus*—			
Total	6,400	8,900	+2,500
From Germany	3,200	3,400	+ 200
,, Germany (Reparation account)	30	330	+ 300
,, United States ...	400	980	+ 580
,, Belgium	900	740	− 160
Carbons, electric—			
Total	32,000	37,000	+5,000
From Germany	18,000	24,000	+6,000
,, Jugo-Slavia	1,000	—	−1,000
,, United States ...	11,000	10,600	− 400
Insulators, porcelain, &c.—			
Total	5,800	4,200	−1,600
From Germany	2,600	1,400	−1,200
,, United States ...	—	50	+ 50
,, France	2,400	2,060	− 340
Accumulators—			
Total	850	2,100	+1,250
Other electrical apparatus and parts—			
Total	16,000	25,000	+9,000
From France	3,300	3,500	+ 200
,, Germany	7,200	8,600	+1,400
,, Germany (Reparation account)	400	730	+ 330
,, Switzerland	1,300	1,500	+ 200
,, United States ...	1,000	1,700	+ 700
,, Great Britain ...	1,000	6,000	+5,000
Electric lamps—			
Total (thousands) ...	14,200	19,300	+5,100
From Austria	1,800	1,700	− 100
,, Germany	4,666	6,300	+1,634
,, Holland	6,019	9,700	+3,681
,, Switzerland	187	430	+ 243
,, Hungary	1,347	704	− 643
Insulated electric wire or cable, covered with rubber or textiles	2,000	1,700	− 300
Ditto, armoured, including submarine cables	4,000	2,900	−1,100

Exports.

†*Insulated electric wire or cable, covered with rubber or textiles*	3,700	3,900	+ 200
†*Ditto, armoured, including submarine cables*	27,000	40,000	+13,000
Electric generators and motors—			
Total	22,900	16,700	−6,200
To Belgium	530	580	+ 50
,, France	3,200	570	−2,630
,, Spain	1,100	1,200	+ 100
,, India	5,000	3,800	−1,200
,, Argentina	4,400	3,900	− 500
,, Brazil	2,700	2,400	− 300
Static transformers	1,700	870	− 830
Accumulators	2,100	3,150	+1,050
Magnetos	200	130	− 70
Electricity meters	210	110	− 100
Telegraph and telephone apparatus	350	290	− 60
Radio apparatus	400	360	− 40
Insulators, porcelain, &c. ...	490	2,700	+2,210
Lamps—			
Total (thousands) ...	626	1,856	+1,230

* Including radio apparatus, 1,500 q. in 1927, and 3,100 q. in 1928.

† Principal destinations: Argentina, Peru, Spain, Brazil and Cuba in 1927, and Argentina, Russia, Brazil and Peru in 1928.

British Exhibition in Argentina.

A Large-Scale Display at Buenos Aires in 1930.

WE have made mention in previous issues of the projected British Empire Trade Exhibition which is to be held early in 1931 in the vicinity of Buenos Aires. Further particulars have now been received from the London office of the organisers, the British Chamber of Commerce in the Argentine Republic, 5, Parliament Mansions, Orchard Street, Victoria Street, S.W.1.

An appeal is made to British manufacturers and merchants to support the Exhibition to enable it to attain its objects; they are "to place British trade with Argentina more on a par with British purchases and investments there; to demonstrate, not only to Argentina, but also to South America, that British initiative, British goods, and British salesmanship, backed by British credit, so far from declining, are preparing to reach higher levels than ever before." The Argentine Rural Society has placed at the organisers' disposal, free of charge, its splendid grounds and buildings. The Dominion of Canada has already agreed on the space necessary for a large and representative Canadian exhibit, and other Dominions and Colonies are being approached. The British Government is represented on the London executive committee through the Board of Trade Exhibitions Department and will announce its plans at a later date. The Exhibition grounds cover 25 acres and are close to the centre of Buenos Aires, touching its principal recreation ground, Palermo Park. Two principal railway terminals are within a short distance, and it is well served by tramways and omnibus. The grounds are laid out with fully matured lawns, flower beds and roads. In addition to other equipment, they offer eight large buildings, with a total covered area of nearly seven acres. It is proposed to convert the majority of these buildings into the outward semblance of an old English country town. The result will serve the double purpose of giving an English setting to the exhibits, and also of providing a spectacle unfamiliar and attractive to Argentine and other South American visitors. The last exhibition—apart from the Annual Stock Show—held in the Palermo grounds was one of Argentine manufactures in 1926. It was attended by between eight hundred thousand and one million visitors. There is every reason to suppose that the British Empire Trade Exhibition will attract numbers equal to or in excess of that. The British show has a wider appeal; it is a novelty; it has a business interest for every member of the community; and it is being staged with those additional features which attract and impress a Latin community. The organisers are arranging a very thorough information service for exhibitors and every assistance will be afforded them in shipping and arranging their goods and displays.

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Association of Public Lighting Engineers.

Annual Conference and Exhibition at Bournemouth.

(*Concluded from page* 545)

Compromise in the Use of Illuminants for Public Lighting.

By C. H. Woodward, A.M.I.E.E.

(*Abstract.*)

Compromise appears in two principal forms: compromise in policy and technical compromise.

The first great compromise which faces us is associated with our attempts to find "daylight's" substitute.

In many places the artificial lighting would be popularly described as "equal to daylight"; but if the two illuminations are compared, the truncated or tunnel effect of the artificial lighting completely destroys any general comparison with daylight; therefore, for this purpose, we are confined to small areas and a limited plane, until such time as the illuminating engineer provides us with an artificial bank of white cloud illuminated from below with floodlights and emitting, say, 0.5 lamberts.

One example of an attempt to improve this condition is found in our 75-ft. mast at the pier approach. This has three lights in triangular spacing at the top, providing a large area of fairly uniform illumination.

If no other sources of light are available, any persons or objects in the vicinity of the post are illuminated horizontally, causing heavy vertical shadows, whilst outside a circle of 150 ft. diameter on the ground, the illumination is equally horizontal and vertical. As the tolerance of the sky is from 0.5 to 2 lamberts, we may take an annulus wherein the vertical and horizontal components of the illumination do not vary more than plus or minus two per cent. This will give us an annulus of illumination on the ground of roughly 71 ft. inner diameter and 79 ft. outer diameter, or a total area of 3,800 sq. ft.

Within this annulus the distribution will be comparable with daylight, and if we consider the useful cone of illumination to be that associated with a spacing to height ratio of 4 to 1, the compromise can be evaluated:—$1-3{,}800/\mu(2\times75)^2=1-.054=.946$, or 94.6 per cent. compromise on distribution.

This method is, plainly, only useful where large open areas have to be illuminated.

For ordinary street lighting we shorten the mast and increase the number, largely sacrificing horizontal illumination and substituting vertical, together with reflected light from buildings, &c. This provides an illumination upon distant objects largely vertical, and comparable with that which occurs from a car headlamp, which, whilst useful for showing up obstacles, distorts and magnifies by excessive silhouette and shadow when travelling over a broken road surface with headlamps exaggerating the contour; this effect is always present in the usual street lighting, and exerts a baleful psychological effect.

Another compromise has to be made with regard to the spectral character of the light emitted; this, however, in the case of the well-adjusted gas mantle or the gas-filled tungsten lamp, is of minor importance as compared with distribution. The useful zone is increased in two ways (*a*) by means of suitable reflectors, and (*b*) by means of refracting glassware; where electric lamps are concerned, the compromise can be greatly reduced by their use.

In the gas lamp we have a notable case where difficulty is experienced in directional control other than that already inherent in the shape of the "bag" mantle. The arrangement of a cluster of mantles in the form of a cone gives an improvement, but I await the advent of a cone formation apex downwards, with concentric reflecting vitreosil chimneys, to prevent the gaseous products from one tier of mantles interfering with those above it. If the "chimney" could be metalised in any manner to increase the specular reflection, a great step forward in the matter of light distribution would be gained. This is a matter well worthy of the attention of the silica manufacturer and manipulator.

The electric lamp lends itself to use in conjunction with reflectors and refractors; as, however, these add to the number of reflecting surfaces interposed in the projected light, each surface usually reflecting the light away from the desired direction, it is not as efficient as it might be, and I look forward to the time when the refracting device for various openings and angles will be incorporated in the bulb of the lamp itself.

It has been usually considered necessary to protect high-wattage gasfilled tungsten lamps with an outer globe, well ventilated; this provides another glass surface to become obscured by dust and to reflect and absorb light uselessly. I have had 50 500-watt gasfilled lamps in use since 1919, exposed, on the sea-front, to rain and wind-driven spray, with no protection whatever; during this period I have not had one failure which I could attribute to this treatment. The compromise which was effected in the installation of these particular lamps was the abolition of an outer protecting globe and the substitution of an oversize bulb to provide more uniform gas circulation in the bulb and to avoid excessively hot spots. This has proved effective.

It has been stated and denied that lighted areas exert a "moth and candle" effect upon fast moving traffic. Some of my audience will perhaps have experienced the "pulling" effect when driving a car and approaching another with bright headlights. My experiment, to show this effect, if any, was to get a friend to drive his car with a single headlamp as fast and as straight as possible while I exposed my camera from the top of the cliff. The result was an "inverse moth and candle" effect, suggesting that the bright areas gave the driver confidence to explore the terrain, and the dark patches forced him to seek the protection of the kerb.

The position of a post on a sharp bend in the road usually calls for a little adjustment in the scheme.

Great uniformity in artificial light distribution is undesirable, and the excessive use of semi-opaque bowl fittings, making use of excessively bright ceilings as a source of illumination for indoor lighting, is to be deplored. In a spacious dining-room well-shaded fittings emphasise the table furnishings, and throw the room surroundings into shadowy relief: The same room, illuminated from the ceiling, gives as much prominence to the wallpaper and the distant corners as to the dining table, making the whole scheme bizarre and vulgar. The same can be accomplished in street lighting, and rather than make a large open space an overlit and glaring area like a sunlit desert, the lighting engineer, by the careful choice of lighting unit and position, can do much to change the space into an Aladdin's Cave without sacrificing efficiency from the traffic point of view, and probably with a definite economy.

The question of decorative compromise is seriously effected in the case of the modern gas lamp. One efficient lantern requires a preheating chamber, an efficient chimney, a large globe, an elastic suspension, a governor, a controller and other gadgets, such as mixture controls and bypasses. How all these ingredients are to be incorporated in a decorative scheme combining pleasing appearance with efficiency is difficult to foresee. A pressure governor, which can be incorporated in the lantern, and which will stand the high temperature whilst being perfectly reliable, is badly needed, and the same may be said of the controller. At the present time we accept them as separate attachments, largely because their unreliability calls for separate detachment.

It is in this matter of decorative compromise where the electric filament lamp has advantages over the gas mantle; it can be enclosed in any shape or size of decorative or directive lantern, and can be "burnt" at nearly any angle. These are the characteristics which largely determine whether it is worth while to pay the extra cost which this illuminant frequently demands.

A compromise which the lighting engineer should carefully watch is one which the gas mantle manufacturer is called upon to exercise. I refer to the ratio of colorant to base. This ratio requires very careful adjustment for each type of mantle, and only those mantles which provide this condition should be used. The question of which is the best mantle can only be decided by the combined use of an experimental burner bar fitted with a pressure governor, meter, burners with good mixture control, so that the zone of "high combustion" may be made to ccincide with the "bag" of the mantle, and a photometer to watch the variation in luminosity or to make comparisons. A further useful adjunct is a micro-telescope with dark glass with which to watch for disintegration of the mantle fibre, both generally and specially, for local disintegration due to impurities which act as fluxes and produce holes.

A somewhat similar compromise has to be made by the electric lamp manufacturer; he has to adjust the compromise between luminous efficiency and life of filament, which is arranged upon a rough basis of 1,000 burning hours. It has been proposed that its adjustment shall be subject further to the cost per unit at which the lamp will actually be run.

A lighting unit with a practically concealed emitter, and with a good polar curve, does not appeal to the public as well as a liberal light source with possibly a poor polar curve.

In an ordinary good installation, where the diversity factor is not greater than 20/1, it is an interesting experiment to watch, from a point 60 ft. from the post, a person travelling along the pavement, and to critically note the general character of the image presented to the eye. He will see the person clearly

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defined as to colour of clothing and features under the post, but at a distance of 10 yd. beyond this point he will note that the features are uncertain and the clothing cannot be distinguished, while further on it will be noted probably that he is seeing the outline of the person observed against an illuminated background or silhouette. During daylight the object viewed is usually bright, compared with the background, and the average disparity would probably not exceed 20 per cent.—taking averages and ignoring colour contrast—whereas with artificial lighting the disparity reaches closely to 100 per cent. This suggests a natural classification for public lighting: one class which provides an illumination of the "positive" type, in which viewing is secured with a silhouette to bright ratio of not more than, say, 40 per cent., and applicable to congested traffic areas, large open public spaces, business centres and pleasure centres; the other class of the "negative" type, which utilises silhouette together with "glint" chiefly, and which constitutes very largely the bulk of the present-day suburban lighting.

The lighting engineer should not only concentrate upon his lighting unit, but also pay attention to the background, with a view to improving its reflecting factor. It is necessary for the road-making authority to co-operate with him to make the roadway safer for transit by employing materials that will improve the reflection factor of the roadway, which has so notably suffered since the general use of tar and bitumen products.

Discussion on Mr. Woodward's Paper.

Mr. Haydn Harrison, of London, said that appearance did not always mean a great deal of expenditure, but he hoped that engineers would give efficiency their first consideration. As to the problem of glare, there was no more delicate subject. He had noticed that it was much easier to see on concrete roads, which were not black, than on the black tar-paved roads which were being adopted in most countries. He hoped that one day lighting engineers would have a say on the question of road surfaces.

Mr. E. H. Horstman, Bath, made an appeal for ornamental lanterns, on the ground that nature abhorred straight lines, and liked curves.

Mr. E. J. Stewart, of Glasgow, said that there was nothing technical that would prevent their having direct illumination; the great difficulty was to avoid glare.

Replying, Mr. Woodward said the problem of how to avoid glare was the lighting technician's bugbear. They had not got the solution yet, but were approaching the solution of the trouble.

Private Lighting as an Aid to Public Lighting.

By J. S. Dow.

(*Abstract*).

Public lighting is no longer regarded as comprising merely the lighting of streets.

During recent years the public lighting engineer has had to add to his primary duty of attending to the public lamps, the study of the use of light as an aid to the control of traffic. In the future, maybe, local authorities will ordain that every house must bear its appropriate luminous and legible number, and that, for the benefit of the stranger, all essential public buildings shall bear a luminous description of their functions. The supervision of such devices may well be added to his duties. Furthermore, floodlighting and the arts of advertising or giving information by means of light, which at present are used almost exclusively by private persons or firms, may also prove of public service. The public lighting engineer of the future should therefore be an illuminating engineer, but taking within his province every form of lighting that contributes to render a city visible by night.

Theories of street lighting are still based very largely on the original conditions when a few public lamps, at long intervals, furnished the only available light in a street. It was scarcely contemplated that such lamps could *illuminate*, in the sense of rendering objects easily visible. They served rather as isolated beacons, and in the minds of many people that idea still survives. Illuminating engineers are secretly aware that it is an almost impossible problem to furnish adequate illumination from lamps at intervals of 100 ft. or more.

But the conditions are abnormal in other respects. The eye, exposed to the surrounding gloom of soot-darkened and feebly illuminated surfaces of neighbouring buildings, is in a state of dark-adaptation. Its sensitiveness to the isolated bright specks of light seen against this sombre background is enormously increased, and its powers of perception are at a minimum. (It is a fact that, in the case of many eyes, the enlargement of the pupil aperture diminishes acuteness of vision, just as a large stop on a camera lens impairs its definition). Glare is largely a matter of excessive contrast. Early workers laid down the rule that the contrast between the brightest and least bright objects within the field of vision should not exceed 100 : 1—a condition that can be readily complied within the cast of interior lighting, but is almost always violated in street lighting.

Moreover, in any moderately well-lighted interior, objects are seen in their entirety because they are illuminated by diffused light coming from many different directions; but in a street this condition is not realised. Light is furnished only by individual lamps at long intervals. Frequently only the outlines of things are seen, sometimes as an object which is somewhat lighter than its background, but quite as frequently "in silhouette," *i.e.*, a black outline seen against a splash of light on the wet or shiny roadway. It is not surprising that such conditions render the prediction of visibility a difficult and somewhat complicated problem.

Apart from the technical difficulties of street lighting referred to above, there is the psychological difficulty that there is not the same direct appeal to self-interest as is the case of a large shop or factory.

There is, however, another possibility—the provision of special public lighting by private aid. Instances are furnished by the "parade lighting," installed in some streets in London, Sheffield, and other cities, maintained partly by a contribution by local merchants. In the United States this plan has been adopted on a much more extensive scale. Occupants of stores and business premises in important streets have consented to share in the initial cost of the installation, and have responded readily to the argument that better lighting attracts custom. But the introduction of "a blaze of light"—which in practice means "glare"—should be discouraged. Those who contribute to such supplementary lighting may feel that their own wishes should be respected, but the needs of those who use the street must also be studied. Hence this additional lighting should be provided by dignified and pleasing units, and the transition from this brightly-lighted area to the lower adjacent illumination should be *gradual*, so that drivers of motor vehicles would not be dazzled by sudden contrasts.

It would seem that the motorist might well bear part of the cost of public lighting, especially on arterial roads.

The problem of rural highway lighting has been exciting interest in America. Doubt appears to exist whether the authorities possess powers to deal with the problem. Meantime property owners in the vicinity of Detroit, Albany, and Cleveland have paid for lighting installations by private subscription.

Much of the exterior lighting adopted by stores, restaurants, and places of entertainment, in their own interests, forms a useful aid to public lighting. Concealed show-window lighting, for example, helps to enliven a street, and relieves the excessive contrast between public lamps and dark surroundings. The growing practice of keeping such windows lighted after business hours should be encouraged by the granting of special rates for "after-hour" lighting. The installation outside the Galleries Lafayette, Paris, consumes as much as 625 kW per hour—an amount which is roughly equivalent to the total consumption for public lighting in such towns as Epsom, Horsham, and Windsor.

One of the first essentials for successful floodlighting is a light exterior. The grime-encrusted surfaces of buildings present difficulties, and the future development of floodlighting in this country seems to be linked with the question of smoke-abatement.

A third source of supplementary street lighting, from illuminated signs, may also be of value. One can conceive in the future streets lined by luminous light-surfaced buildings, where the intrusion of lamp-posts would seem an absurdity. If the idea of incorporating lighting elements in the frontages of buildings thus became general, a natural step would be for the authorities to require provision to be made for the inclusion of public lighting apparatus when the plans are passed. Streets would then be lighted from units mounted at frequent intervals on the frontages of buildings, and falling naturally into place in the design; the actual street area would be freed from the obstruction of lamp-posts and from the unsightly appearance of cables spanning the roadway.

Owners of buildings can help towards the solution of the lighting problem by keeping the surfaces of buildings moderately clean, so that they serve as diffusers of light. The attachment of brackets to frontages of buildings, which would often render lamp-posts unnecessary in narrow streets, is usually difficult to carry out in this country, unless (as in the City of London) special powers have been obtained. The writer understands that in Cologne the centrally suspended lamps are supported throughout from brackets attached to the buildings, with a spacing ratio of only *three to one*.

Attention has frequently been called to the extraordinary variations in existing rules and regulations governing exterior lighting. In various cities permission has to be sought from quite different authorities (sometimes several in one and the same town), and each has its own code of rules. In some cases these rules are concerned mainly with details of construction and have not been revised for many years; they seem rarely to be framed to give guidance on the point of greatest interest from the standpoint of the illuminating engineer—the degree of brilliancy or constancy of the light. Floodlighting installations are likewise subject to varying restrictions. In some Continental cities it is not unusual to find a number of floodlight projectors mounted on tramway poles for the purpose of floodlighting neighbouring buildings. In this country one of the first difficulties is to find a suitable site for the floodlighting projector.

If it were possible for local authorities throughout the country to be brought into agreement upon broad general principles with regard to exterior lighting, and if such problems could be invariably referred to the same official (eventually, perhaps, the public lighting engineer) for decision, this would help greatly towards the extension of such supplementary lighting.

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It is to be hoped that the time is not far distant when every railway station will bear its name in bold and luminous letters. The names of streets in leading cities are poorly revealed; the lettering is sometimes too small and the casual illumination from the street lamps frequently inadequate.

Whereas shops, theatres, and restaurants use light to impress their existence on the public, the names of places of business or professional men are rarely revealed at night by an illuminated sign. Post offices, police stations, libraries, fire stations, and similar public buildings should all be furnished with a distinctive illuminated description. The problem of locating a house in an unfamiliar neighbourhood by the light of a distant street lamp is frequently an exasperating one. Their numbers should be adequately illuminated—a practice already obligatory in Stockholm, Helsingfors, and other cities abroad.

Enterprising local authorities plant trees, and lay out parks and gardens to improve the appearance of the towns by day, and will come, more and more, to make use of artificial light to reveal their towns by night. The floodlighting of the Pavilion with coloured light, on the occasion of the visit of the I.M.E.A. to Bournemouth in 1927, may be recalled as an effective pioneering installation. Similar enterprise was shown in connection with the recent I.M.E.A. Conference at Torquay. Yet another example was the floodlighting of the city buildings in Liverpool during the "civic week" last year.

In Germany, local authorities and lighting interests have joined efforts in organising "festivals of light," during which the cities were brilliantly illuminated. Floodlighting formed a leading feature of these displays. During the progress of the fête in Berlin the demand for this purpose was as much as 20,000 kW.

There are great possibilities in floodlighting with coloured light, such as that which aroused so much interest at the North-East Coast Exhibition this year. These special displays fall short of what might be possible if local authorities and private interests would co-operate in the introduction of civic lighting as a permanent feature—a continuous effort to render their city beautiful by night.

In applying artificial light to a city by night, the designers have certain advantages. The sun sheds its light on boulevards and slums, and good and bad alike are revealed. By night, however, the artist can select what he will reveal. Noble exteriors, or charming vistas by the riverside, may be illuminated. Less happy aspects of cities may remain mercifully hidden.

More might be done to encourage out-of-door life in our parks by night, in the manner familiar in Continental cities, where illuminated cafés and dancing areas afford innocent enjoyment during summer evenings.

The chief point that the author wishes to bring home is that the application of artificial light in a city is a problem that should be considered as a whole. Local authorities, merchants, and entertainers, and undertakings supplying gas and electricity should get together and make plans for the use of artificial light for their common benefit.

Discussion on Mr. J. S. Dow's Paper.

Mr. E. Stroud, of London, took the view that if the streets were efficiently lighted the house numbers could be seen. With regard to glare, possibly the proper way to light a street would be by close spacing and high posts with reflectors high up. But it was a question of expense; therefore refracting appliances were designed to distribute the light over a wider area as a compromise.

Mr. Haydn Harrison, London, put in a plea for illuminated signs at railway stations. He hoped villages would put up their names in the same way, so that people using the roads would know where they were, and that one day powers would be given so that fittings for lights could be fixed on buildings.

Mr. W. J. Jones, of the Electric Lamp Manufacturers' Association, said that Mr. Dow had put his finger right on the source of the street lighting engineers' trouble when he said it was an impossible problem to furnish adequate illumination from lamps at intervals of 100 ft. or more.

Mr. S. E. Britton, of Chester, was glad, as a motorist, to do without street lighting and to rely upon his headlights. It seemed impossible to put up in rural districts a scientific system of lighting. He thought they should do without ornamental standards, and have a simple system, spending as much money as possible on the lighting. As to the cost of energy, they had found at Chester that electricity worked out at something less than a penny a kWh. Some towns were paying 3½d. a kWh for street lighting, which was nothing less than a scandal.

Mr. James Clark, of Aberdeen, thought the ideal set up by Mr. Dow was quite practicable. Private lighting could be co-ordinated and supplemented in a way to benefit the general illumination. Lighting engineers should form some plan for putting this into effect.

In his reply, Mr. Dow urged that municipal authorities might interest themselves in the question of illuminated signs, and not dismiss them as advertising stunts. It was only by keeping an eye on them and controlling them that they could be prevented from becoming an eyesore.

The National Radio Exhibition.

Impressions of the Show and Notes on Some of the Receivers and Component Parts Displayed.

(*Continued from page* 545.)

THE National Radio Exhibition, having had a felicitous prologue by the Prime Minister, speaking *in absentia* from "The Chequers" through the London (2LO) broadcasting station, attracted a multitude of visitors. During the first few days of the show the 300 stands on which some 193 traders displayed their wares attracted an average of 15,000 people per day. Manufacturers realise their share of responsibility in seeing that the public gets the best which science and the industry can provide, and the value offered the purchaser this season was remarkably good. Several component manufacturers displayed for the first time complete receivers of merit; portable and transportable sets were much in evidence, and combination radio-gramophone developments have been notable. Portables this year have shown a tendency to depart from their original function of outdoor sets, and the old "suit-case" style is giving place to an upright type of highly-polished wood that can be moved from room to room and from house to house, and at the same time be more durable and suitable for indoor use. Portables, as well as the heavier sets, are departing from the battery-fed method with its accumulators and recharging inconvenience. The more modern method is to plug the set into the ordinary domestic electricity supply mains and thus eliminate the use of batteries altogether.

The number of licensed listeners constantly increases (2,805,050 on July 1st last) and, despite its critics, there is no gainsaying the fact that the British Broadcasting Corporation has rendered immense service in disseminating knowledge and raising the standard of æsthetic appreciation. Its potentialities are, however, so enormous that one cannot help sharing the Prime Minister's conviction that the wisest possible direction will be needed if they are to be progressively beneficial.

A suggestion of considerable utility was made Sir William Bull, president of the Radio Manufacturers' Association, at the Press luncheon on September 27th at the Royal Palace Hotel, Kensington. In toasting the B.B.C., he pointed out that many non-technical users, probably in the majority, had not the time, inclination, or requisite skill to maintain their receiving installations in adequate operating condition, and he considered it would be of considerable benefit and profit to all concerned if the manufacturers could institute a maintenance and repair service by means of periodical visits of inspection for an annual fee, and so ensure that receiving sets were kept in proper working order.

Mrs. Philip Snowden, of the B.B.C. Board, responded to the toast, other speakers being Mr. J. T. Mould, chairman of the R.M.A.; Mr. A. Beverley Baxter, editor-elect of the *Daily Express;* and Mr. R. B. Weaver, vice-chairman of the R.M.A.

Adey Radio, Ltd.

One of the novelties of the show is the new portable receiver incorporating an unusual circuit patented by Mr. Horace W. Adey, the nature of which has, however, not been divulged yet. The set should arouse interest, as the extremely simple system of controlling the circuit is claimed to be unique in itself. Each set comprises one tuning condenser and a jack key which is inserted into the set when reception is desired; the key in question locks and unlocks the whole system of operation, and when it is removed it is impossible for anyone to operate the set. The main advantage to the public will not only be the simple method of operation, but also the cost of upkeep, in proportion to the efficiency, which has been decreased, as the battery output required is quite small; there is a big reduction in weight,

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and the decrease in cost to the purchaser, as compared with present-day portables, is attractive, the quality of reproduction being good. Frame aerial tapping, which has played an important part in portable wireless sets to obtain reaction, is no longer necessary. Having heard the set in operation, we await with interest the explanation of how such results are obtained, as there seems to be little incorporated in the

Fig. 6.—Siemens Combined Volt and Milliamp. Meter.

mechanism of the set. Although the inventor considered the circuit stable and satisfactory, he has kept it on test for months, in the meantime getting patents lodged to insure protection. A rather interesting feature, which is very different from the circuits now being used, is that in the event of the anode circuit battery employed to operate the set being reduced by half, the quality of reproduction suffers but little, and the set continues to be quite stable, showing only a slight reduction in volume. The set is British throughout, and is to be made in a London factory in 1-, 2-, 3-, and 4-valve models. The inventor claims that his one-valve set will actually give better reproduction than a crystal set with a very big reserve of power at the disposal of the user. At the moment the general principle of the invention is only being applied to the manufacture of portable sets.

Philips Lamps, Ltd.

A feature of the display of receivers and accessory devices on this company's stand was the type-4009 valve filament-current transformer (fig. 7), which has been designed to operate off the domestic a.c. mains, models being available for the usual voltages. The output is at 2 and 4 volts, the maximum being 5 amperes.

General Electric Co., Ltd.

This company's extensive stand was attractively set out with a colour scheme and subdued colour lighting effects. The display embraced a very varied selection of "Gecophone" receiving sets and components, as well as a complete range of "Osram" valves. The following is a list of the new receiving sets which were exhibited:—A two-valve receiver designed to work off 200/260-volt, 50/100-cycle a.c. mains; a three-valve screen-grid receiver in portable cabinet form (housing both anode and filament batteries); a three-valve screen-grid set for a.c. mains at 200/260 volts and 50/100 cycles; a three-valve short-wave screen-grid receiver; a four-valve screen-grid portable set; a four-valve screen-grid portable set for a.c. mains at 200/260 volts and 50/100 cycles; and a four-valve screen-grid table cabinet model. The new "Osram Music Magnet" constructor's kit, with its special oak cabinet, was also featured and demonstrations of wiring this recever attracted interest. Among the new components which figured on the stands was a two-valve amplifier for a.c. mains; an anode power unit for a.c. mains (20 mA type), an anode power unit for a.c. mains (40 mA type); and a filament "Hiflux" transformer. Among the loud-speakers shown were the following new "Stork" models:—A cone "Senior" plaque model, a cone cabinet model, together with the new "Stork" speaker unit. The valve exhibit included screen-grid valves, pentodes, valves for a.c. mains for both direct running and with indirectly-heated cathodes, new super-power valves, and standard valves for battery receiving sets. "Osram" valves were used in connection with the broadcast reproducton throughout the period of the Exhibition, and many portable set makers notified on their stands that "Osram" valves were incorporated in their sets. The company's photo-cell was demonstrated in one of the cubicles on the gallery.

Mullard Wireless Service Co., Ltd.

On this company's stand was exhibited a complete range of radio valves, speakers and accessories, including the latest additions to its products in the way of a.c. independently-heated cathode valves and the "P.M." filament transformer. These will be of considerable interest to all those interested in working their radio receivers direct from a.c. mains. The following is a *précis* of the Mullard exhibits:—A complete range of "P.M." valves, including "Pentone" five-electrode power-amplifying valves and screen-grid valves, which have the enormous amplification factor of 200, whilst the amplification factors of the P.M.22, P.M.24, and P.M.26 are 82, 62, and 50, respectively. Of especial interest are the new a.c. valves for direct use on mains; they all have a filament voltage of 4 volts and filament current of 1 ampere, and are made in four types: S .4V, 354 V, 164 V, and 104 V, which, respectively, are screen-grid, super-detector, l.f. amplifier, and power valves. The series of "Pure Music" speakers possesses unusual features in design of diaphragm and magnetic system; they are both of the cone type with a balanced armature, and type "C" incorporates a "tone-filter" operated by means of a switch, being suitable for use on a table or other flat surface, or, alternatively, it can be suspended from a wall. In both cases the connections are reversible without fear of injury to the speaker. The "Permacore" l.f. transformer is of quite new design: small, light, and neat, it is capable of a high performance and has a ratio of 3:1. The core is made of a special alloy having exceptionally high permeability; the primary coil is wound with silver wire and the secondary with nickel. It is claimed to be free from resonance peaks and "blasting."

The "P.M." filament transformer is intended for supplying current from a.c. mains to the heater circuits of a.c. valves of the indirectly-heated type. In design, it ensures absolute safety in operation and in every way complies with the regulations of the Institution of Electrical Engineers. It has a rated output of 5 amperes at 4 volts, having a centre tap for reducing the possibility of "hum" in the receiver. It will operate satisfactorily at any supply frequency between 40 and 100 cycles per second, and is made in six types suitable for use with mains voltages covering a range of from 100 to 260 volts. The anode supply unit is designed to provide the necessary high voltage for valve receivers from alternating-current electric lighting house mains by merely inserting a plug into a lamp holder or wall socket. It provides for four different high voltages, which may be connected as required to the various valves in a receiver, and is supplied with a DU/2 rectifying valve. The "P.M." resistance-capacity coupling unit incorporates two special devices for the prevention of distortion due to the passage of high-frequency oscillation through the l.f. stages.

Siemens Bros. & Co., Ltd.

This exhibit consisted principally of dry batteries, rechargeable Leclanché cells, grid-bias batteries, the GT dry cell being

Fig. 7.—Philips Filament-Mains Transformer.

provided with a flap for fixing it to the set, and special high-capacity batteries for portable sets. A section was also devoted to batteries particularly suitable for use abroad where the climatic conditions are usually adverse to primary cells and batteries. A display of "Crystacel" accumulators of the glass cell type was included, and we understand they are now supplied in the dry charged state with free metal carriers.

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Two high-class radio testing instruments were shown: one of them is of novel construction and embodies six ranges, a removable selector plug determining the range in use. Both instruments are of the moving-coil type, of high resistance and robust construction.

The type-650 B combined volt- and milliampere meter (fig. 6) has six ranges (3, 15, and 150 V and 7.5, 75, and 750 A) and is suitable for testing filament and anode batteries and for measuring filament current up to 0.75 A and the plate current of valve receivers. The instrument is of a simple form, with two terminals only for connecting purposes, a removable selector plug determining the range in use. When used as a voltmeter the instrument has a resistance of about 150 ohms per volt.

A very interesting booklet has been produced, entitled "Inside Knowledge," primarily for the benefit of those users of radio sets who are not technical experts, but are interested in obtaining the best results from their wireless apparatus. It is informative and well written.

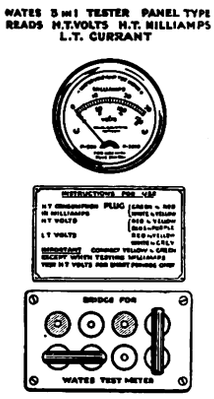

Fig. 8.—Wates Meter.

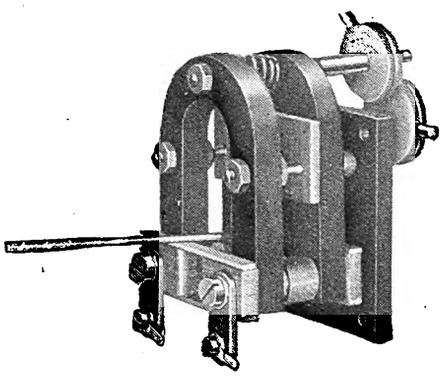

Fig. 9.—Wates Loud-speaker Unit.

Fig. 10.—Cossor Pentode Valve.

A. C. Cossor, Ltd.

The characteristics of the company's latest valve, which incorporates a new process filament, should be noted. The filament has a tungsten core, which makes it even more pliable and robust than the old kalenised filament. In addition to these important mechanical advantages, the improvement is claimed to give an emission 28 per cent. greater than before. In order to prevent trouble either from the electrodes touching, or their microphonic tendencies, Cossor screened-grid and pentode valves (fig. 10) have an interlock construction, a patented feature; fig. 11 shows this in detail, the particular valve shown being the screened-grid one. The diagrams are self-explanatory, and attention is drawn to the "seonite" insulator, which is clearly shown in the first two pictures. The method of bracing the anode will also be found of interest, while the screen will be seen to very effectively shield the anode from the outer (or control) grid.

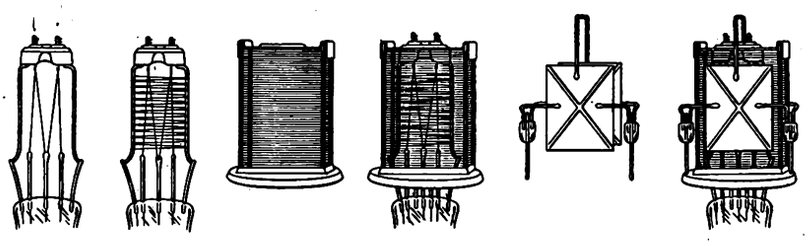

Fig. 11.—Cossor Screen-grid Valve Electrode Construction.

The indirectly-heated mains valves and the new directly-heated mains valve, which has just been introduced by this firm, should be of particular interest. They are intended for use on alternating current fed from a power transformer. Table I gives the characteristics of these valves, and it will not be out of place to mention that when wiring filament circuits for them unusually heavy-gauge wire will be required, as each valve requires 0.8 amp. and the detector requires 2 amps.

TABLE I.—A.C. Valve Characteristics.

Type.	Fil. Volts.	Fil. Amps.	Impedance.	Amp. Fac.	mA/v.	Max. H.T.	
82 M.D. ...	0.8	2.0	23,000	20	0.86	150	
88 M.L.F. ...	0.8	0.8	10,000	12	1.2	150	
88 M.R.C. ...	0.8	0.8	40,000	36	0.9	150	
88 M.H.F....	0.8	0.8	17,000	21	1.23	150	
88 M.S.G. ...	0.8	0.8	200,000	170	0.85	150	s.g. volt 60
88 M.P. ...	0.8	0.8	7,000	8	1.14	150	

The 1930 Cossor "Melody-Maker" is much more efficient, more powerful than its two well-known predecessors, and is of very pleasing appearance, a cabinet (fig. 12) of two-tone blue lacquer with oxidised silver escutcheons being used to house the complete set. One of its features is the new synchronised control, which makes tuning possible with only one knob, while one knob to change wavelengths and one to control volume complete the lay-out; there are no coils to change. There are two models, one for working entirely off a.c. mains and one for battery operation, and in both cases simplicity of assembly is the keynote, there being actually only ten components and twenty wires. Another line is the two-valve a.c. mains set, one model of which will be similarly equipped as the three-valve "1930 Melody-Maker," while the other is housed in a wooden cabinet complete with a loud-speaker.

Standard Wet Battery Co.

We have had a sample of the Wates "three-in-one" panel meter (fig. 8) for mounting on a receiving set, the use of which should help considerably in maintaining consistent operation of the set. It will measure filament voltage (0 to 6 V), anode voltage (0 to 150 V), current (0 to 30 milliamperes), and other values by changing the plugs in the sockets below the instrument, which forms a bridge, the plugs being variously coloured to avoid mistakes. The panel meter and bridge consist of a test volt-ampere meter with three scales on a neatly engraved aluminium dial with red and black figuring, mounted in case with a nickel-plated rim and suitable for fixing in the panel; a 2-inch hole is required, and the meter is clamped in position by means of a special device fixed at the back. A bakelite moulding, also fixed in the panel, is fitted with eight coloured circular disks and three plugs, each having two plug points, for inserting in the disks. The connections are clearly indicated on the ivorine tablet above the bridge.

All this company's testing instruments are operated on the polarised-magnet system, which is entirely different from the moving-iron type, and enables quite an accurate movement to be produced at a price below that of the moving-coil type, although the accuracy is quite sufficiently good for all ordinary radio testing purposes.

On this company's stand products of the Shaftesbury Radio Co. were also displayed, which has developed the Wates "Star" loud-speaker unit having unusual features. Four laminated pole-pieces are provided with four coils; there are two horse-shoe magnets, and double adjustment of the magnets is provided for. The device is illustrated in fig. 9.

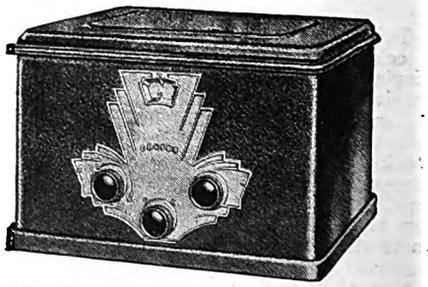

Fig. 12.—Cossor "Melody Maker."

Gambrell Radio, Ltd.

In addition to a variety of types of well-made radio receivers, this company produces sets combined with electrically-driven and electrically-reproducing gramophones. The "Novotone" model, while similar in appearance and with respect to controls, includes the following new features:—The "Novotone" attachment compensates in an electrical way for the losses in recording, pick-up, and amplification, and thus improves realism; it incorporates a moving-coil speaker, and is arranged to automatically adjust voltages when the set is switched over to reproduce records. Much has been achieved in the past two years in reproducing sound from gramophone records, though even the advent of the electrical pick-up has gone but a little way in solving the problem of obtaining absolutely realistic reproduction. The primary cause of the trouble is the record itself, for notes below the middle piano scale (under a frequency of 250) are not recorded on the record in anything like their true proportion as originally played,

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due to the material limitation imposed by the groove-walls in the record, because for a given volume of sound the lower the note the deeper should be the cut in the groove-walls. The frequency characteristic of the recording system is a horizontal, approximately straight, line from 250 cycles to 5,000 cycles; below 250 cycles it is made to fall away regularly, since, the amplitude varying inversely as the frequencies, there would be danger of one groove encroaching on the next if a loud sound at a low frequency were recorded at its natural strength; above 5,000 cycles and below 50 cycles it cuts off abruptly. In ordinary records it is necessary to restrict the amplitude of notes below about 250 cycles in order that the vibrations may be contained within the pitch of the standard groove. Obviously, at the very beginning of things is a considerable lack of bass notes, and the deeper the note the less, in proportion, is it provided for. Moreover, the average pick-up is generally admitted to give poorer results in the lower and higher registers, as compared with the middle register. Finally, although it is possible to build a theoretically perfect amplifier, it, too, is often deficient in bass notes and sometimes in the higher notes as well. The cumulative effect of these faults is considerable, and must of necessity produce an output of sound from the loud-speaker different from the original music. The "Novotone" compensates for these losses and causes the weak frequencies to appear in their true proportion, giving gramophone music realism. However, it reveals the weaknesses of certain types of loud-speaker, some of which are not quite capable of responding to a fairly powerful bass note. It is, therefore, not advisable to use the "Novotone" with speakers in which the moving armature in its operating position is extremely close to the pole-pieces. Not only is the new device claimed to put in the bass notes at their proper strength (without that "booming" which results when mechanical resonances are used to "fake" up the lower frequencies), but also the higher notes at their proper strength. It also raises the whole sound output to a much higher level, making the general volume of sound some four or more times greater (according to the type of music) than that secured previously. The "Novotone" is connected in between the pick-up and amplifier without the aid of valves or other apparatus. It was originated by Mr. N. W. McLachlan, D.Sc., M.I.E.E., F.Inst.P., and the principle of his tone compensator can be applied equally well to correct the bad quality sometimes heard in the reproduction of talking kinematograph films.

(*To be continued.*)

Large Water-cooled Transformers.

The 33,000-kVA, 145,000-V transformers recently supplied by the Metropolitan-Vickers Electrica Co., Ltd., to the Brazilian Hydro-Electric Co., Ltd., are of unusual dimensions.

AMONG recent transformer shipments from the Metropolitan-Vickers works is a 33,000-kVA bank of water-cooled high-voltage outdoor transformers for the Parahyba power station of the Brazilian Hydro-Electric Co., Ltd. These transformers, figs. 1 to 3, have a number of interesting features, especially with regard to the provision of water-cooling for such large units and the unusual proportions of the units necessitated by the requirements of transport within the restricted loading gauge of the railway to the site.

The Parahyba power station is located on the Parahyba River about 100 miles north-east of Rio de Janiero. The new transformers are to constitute the third three-phase bank, and will operate in conjunction with a third 33,000-kVA generator. The output of the three generators will be stepped up by the transformer banks and transmitted approximately 95 miles over three high-voltage circuits in parallel to the Cascadura sub-station where the system is linked with lines from the Lages power station.

The "Metrovick" transformers have been designed to operate in parallel with two existing 25,000-kVA banks supplied by the Westinghouse Company. The full winding ratio, with delta-star connection, is 6,600-145,000 volts, and full capacity taps are provided on the high-voltage side for 138,500 and 132,000 volts, an externally operated off-load tap-changing switch being fitted to each transformer.

The bank is designed to operate with the high-voltage neutral ungrounded, and the windings were tested at a specified pressure of 304,600 volts for one minute from the high-voltage windings to the low-voltage windings and earth. The high-voltage bushings, which are of the condenser type, were tested at 440 kV dry and 400 kV wet. The transformers were also subjected to a specified test consisting of a dead short-circuit across the secondary terminals with the rated voltage maintained at the primary terminals for two seconds.

The water-cooling coil of seamless copper tubing, arranged in sections, is located inside the upper portion of the tank, and is so mounted that the transformer may be withdrawn from its tank without in any way disturbing the coil. A valve is fitted on the inlet side of each coil to regulate the flow of water, and a sight flow indicator is provided at the outlet of each coil. The flow indicators are of the bucket type and are fitted with electrical alarm contacts, so that warning is given in the event of the water supply falling below a predetermined limit. Both inlet and outlet ends of each section are arranged at the bottom, so that the water may be completely drained out when necessary.

The temperature rise of the transformers at any voltage is not to exceed 55 deg. C. above the temperature of the cooling water when the supply of water is maintained at 36 U.S. gallons per minute. Each transformer unit is fitted

Fig. 1.—Single-phase Transformer, without Tank.

Fig. 2.—Single-phase Unit complete in its Tank.

Fig. 3.—Single-phase Unit, showing Water-cooling Connections.

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with two temperature indicators of the type in which the temperature of the hottest part of the winding is reproduced in an element, external to the winding itself, by means of a current which is proportional to the load current. In the case of one indicator of each unit, the heating current, supplied from a current transformer, flows through the metal bulb of a vapour-pressure thermometer. The bulb is mounted in the oil near the top of the tank, and is surrounded by a suitable insulating tube, so that the drop in temperature between the bulb and the oil is the same as that between the main transformer windings and the oil. The temperature of the bulb is shown in a dial indicator, calibrated in degrees Centigrade and mounted on the transformer tank. In the case of the other temperature indicator of each transformer, the heating current passes through a heating coil in which is embedded a copper resistance element, the temperature being measured by the change of resistance of the element; the latter is arranged for connection to the existing station equipment of Wheatstone-bridge-type recorders, which are also calibrated in degrees Centigrade.

Owing to railway clearance restrictions in Brazil, it was necessary to limit the length and breadth of the transformer tanks, each unit being transported to site on its side. The floor space occupied is therefore relatively small, and the transformers are abnormally high; the tank is approximately 8 feet square, and the height from the bottom of the truck to the top of the high-voltage bushing is 24 feet. Each transformer, mounted in its tank, was conveyed from the M.V. Trafford Park works to the Liverpool Docks by road on a 60-ton rubber-tired truck.

The British 132-Kilovolt Grid.

Extracts from a paper read before the International Conference on Large Electric Systems held in Paris in June, 1929.

By J. R. BEARD, M.Sc., M.I.E.E.

THE method employed in settling the transfer capacity to be provided in the various parts of the grid is as follows:—Estimates of the probable maximum demands and load factors for a number of years ahead are first agreed with each of the supply authorities in the area. The generating capacities and operating results of the various selected stations are sorted into a rough order of economy in operating costs, suitable adjustments being made to separate the costs solely dependent on output from those independent of output.

With this as a basis steps can be taken (1) to determine the necessary amount of new plant to meet the anticipated demand in five or six years' time and its most economical location; in the large area covered by one of the schemes ample security can be given by 15 per cent. of spare plant at the winter peak; as the various schemes are linked with each other, the proportion of spare plant may gradually be reduced to about 10 per cent.: (2) to segregate the generating plant into three classes of station intended for normal operation during the winter for three shifts, two shifts, and one shift per day, respectively. This is settled mainly on the basis of running cost, but account is also taken of other factors, such as proximity to the heaviest loads. For the type of load in such an area, with a load factor of rather over 30 per cent., it is found that about 50 per cent. of the plant capacity must be operated on a three-shift basis, about 25 per cent. to 35 per cent. on a two-shift basis, and the remainder on a one-shift basis. Due to plant maintenance during the summer months, the amount of plant maintained on a three-shift and two-shift basis remains approximately constant throughout the year, but many of the one-shift stations can be closed down entirely for six to eight months of the year.

Transfer capacity is provided in duplicate for the following conditions:—

(1) All load fed *from* the grid to an undertaking which has no selected station, and is therefore dependent upon the grid;

(2) All load fed *into* the grid from a selected station at time of peak load (assumed to be the amount by which 90 per cent. of the maximum steaming capacity of the station exceeds the owner's own requirements);

(3) All load fed *into* a selected station from the grid, if the largest machine in the station should chance to be out of commission at the time of peak load, and the remaining machines are running at full output;

(4) All load supplied *from* the grid during the morning peak load to undertakings having a selected station which is only operated in the evening shift.

Duplicate capacity is not provided for the transfer from the grid to a two-shift or one-shift station immediately before it is due to start up or immediately after it is due to shut down. Any interruption to the grid supply under such conditions is assumed to be dealt with by a short extension of the running period of the station affected.

Calculation of expected transfer capacities over a period of years brings out the interesting result that the transfers over the grid do not increase at nearly such a rate as the general increase of load, and that, in consequence, the lay-out and capacity of the grid can be settled to deal with the position ten to fifteen years ahead, without excessive immediate expenditure.

For the main grid 132-kV was found distinctly the most economical voltage for the conditions to be met. Experimental installations of 132-kV cables of the oil-filled type developed by Mr. Emanueli have already been decided upon for two connections from the 132-kV system into the London area. These connections are from Kidbrooke to Deptford (3.3 miles), and from Wimbledon to the station now being constructed at Battersea (5.3 miles). They will each consist of two three-phase circuits of three 0.2 square inch single-core cables laid direct in the ground.

Wayleaves.—The Board is in the same position as any other undertaking as regards the wayleaves for its lines, except it has also the power to obtain compulsory wayleaves over any land by a complicated and lengthy procedure involving a special order which has to be submitted to Parliament.

From the outset the Board has taken the view that it should not use its powers in an arbitrary spirit, but should strive to meet all reasonable public and private opinion. At the same time it is realised that the construction of steel-tower 132-kV lines is essentially different from that of the wood-pole lines hitherto generally employed at lower voltages. From the point of view of cost steel-tower lines must have a reasonably constant span, and height and angles must be avoided where possible. Fortunately the same requirements are also necessary if the general appearance of the line is considered. On representative routes so far constructed or surveyed, it has been found possible to restrict angle towers to 8 per cent. of the towers, and special tower extensions to 9 per cent. of the towers. This has necessitated two, and sometimes three, surveys of nearly half the routes in order to make the best compromise between the interests of the landowners, the Post Office and the Air Ministry, the general effect of the lines on the countryside, and the best engineering routes.

The yearly wayleave rental and compensation standardised by the Board are as follows:—

	132 kV lines	Lower voltage lines.
To the owner of the land	5s. per tower ...	1s. for each leg of each mast or pole
	1s. for each crossing not involving a tower	6d. for each stay
		1s. for each crossing not involving a mast or pole
To the cultivator of the land ... .. (whether owner or tenant).	15s. for each tower which impedes ploughing ...	1s. for each leg of each mast or pole which impedes ploughing
	5s. for each tower which impedes mowing of grass	6d. for each leg of each mast or pole which impedes the mowing of grass

In addition, cultivators are also allowed compensation for any damage to crops due to the erection, inspection and maintenance of the lines.

Line conductors.—The standard conductor consists of a central core of 7 steel wires, each 0.11 in. diameter, surrounded by 30 aluminium wires of the same diameter in two layers. The overall diameter is, therefore, 0.77 in., giving, with the spacings adopted, a critical corona limit of 184 kV under normal atmospheric conditions. The conductor has a resistance equal to that of 0.175 sq. in. of copper. The maximum tension is 8,000 lb. with ½ in. radial thickness of ice at 22°F. and a wind pressure of 8 lb. per square foot on the whole projected area of the ice-covered conductor. This gives a

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factor of safety of 2.2. The most economical span with such a conductor is about 1,000 ft., but a standard span of 900 ft. has been adopted. The relatively low tension and short span have been adopted to minimise the risk of vibration troubles, and, with the same object, the point at which the conductor clamps pivot is kept as close to the conductor as possible.

Earth conductor.—The single earth conductor consists of 12 aluminium wires in a single layer. The protection of the steel core is increased by giving it a bituminous coating before the aluminium wires are laid on. The use of a steel-cored aluminium earth conductor is primarily to keep its life equal to that of the line conductors, as the life of a galvanised-steel earth conductor is only some 15 years, and may be much less in the industrial areas. An added advantage of a steel-core aluminium earth conductor is that by its low resistance it diverts a considerable proportion of fault currents from the earth, and, therefore, reduces the inductive effect of faults on parallel communication circuits. Apart from its extra cost (about £30 a mile) its only disadvantage is that it may not be so effective as a plain steel earth conductor in absorbing the energy of surges in the line conductors.

The towers are designed for a minimum ground clearance of the conductor at 122°F. of 22 ft., and for a factor of safety of the towers and foundations of 2.5 under the maximum conductor loadings, and with a wind pressure of 25 lb. per sq. ft. on 1½ times the projected area of one face of the towers. The factor of safety is 1½ under broken conductor conditions. The number of line conductors which it is assumed may be broken is one line or earth conductor for single- and double-circuit straight-line towers, two for single-circuit angle towers, and four for double-circuit angle towers. The minimum normal clearance between live metal and the tower steelwork is 3 ft. 6 in. under the worst conditions of line displacement. Provision has been made for increasing the length of the insulator string up to that corresponding to 11 units at 5-in. centres, without encroaching on the main clearances to cover any specially difficult atmospheric conditions.

Provision has been made for the following variations from normal conditions:—

(a) Straight line towers for angles of deviation up to 2°, provided that the sum of the adjacent spans does not exceed 1,600 ft.;

(*b*) The height of all towers can be raised by the addition of extension pieces at the base;

(*c*) Each tower is capable of carrying the vertical weight of 1,500 ft. of conductors (to deal with towers on ground at different levels);

(*d*) All towers may be used at their maximum angle of deviation for spans greater than the normal 900 ft., provided that no span exceeds 1,100 ft. and that the sum of the adjacent spans does not exceed 2,000 ft., with the exception noted in (*a*) above;

(*e*) Angle towers may be used in straight line positions, when the sum of adjacent spans may exceed 2,000 ft., provided no single span exceeds 1,500 ft.

Each section of line between transforming stations is normally given one complete transposition. On the double-circuit lines this is done on a 30° angle tower with special cross arms, and on single-circuit lines in three stages, at each of which one of the standard towers is turned through 180°.

Galvanised mild steel has been standardised after consideration of various non-corrosive steels and of painting as protection in place of galvanising.

	Comparative costs of erected towers.		Total annual expenditure in 20 years for alternative surface treatments.
(1) Galvanised mild steel towers unpainted	100	...	100
(2) Stainless steel towers ungalvanised and unpainted	700 (approx. only)	...	(Too high to be considered)
(3) Pure iron towers ungalvanised but painted ...	130	...	ditto
(4) Galvanised copper-bearing steel towers unpainted	110	...	ditto
(5) Galvanised mild steel towers painted one year after erection with two coats of paint	107	...	220
(6) Mild steel towers ungalvanised below cross arms, this part painted with one coat at works and whole tower painted with two coats on site	101	...	242
(7) Ungalvanised mild steel towers painted with one coat at works and two coats on site	98	...	216

Three types of foundations, *viz.*, excavated earth, concrete ball, and ordinary concrete are used, the type chosen depending on the nature of the subsoil.

The concrete ball foundation is new to Great Britain, but it is widely used in America. It is made by drilling a cylindrical hole for each tower leg and expanding the lower end of the hole to a spherical form by exploding a charge of dynamite. The tower leg stubs are fitted into position by means of a template, and the cavities are filled in with concrete.

Insulators.—Suspension insulators will be used in strings of nine units of the cap-and-pin type at 5 in. centres with ball and socket fittings.

The specified electro-mechanical load is 10,000 lb. The electrical requirements of the insulator chains are defined by relation to their wet flash-over value. Each insulator chain is provided with a guard ring at the conductor end, and with arcing horns at the earthed end. The object of the guard rings and arcing horns is to prevent damage to the line conductors, clamps, and insulators when a flash-over occurs, and also to equalise the voltages taken by each unit of the insulator chains. The relative position of the arcing rings and horns, together with the number of units forming an insulator string, is such as to give a minimum wet flashover voltage of 340 kV. The normal voltage to earth is 76,000, and the factor of safety is therefore 4.5.

The use of arcing rings and horns is by no means standard practice, although the majority of experienced operating engineers seem to be of the opinion that these devices are of very definite value. As American experience has shown that light horns, designed principally with a view to improving the potential distribution on the insulator chains, were inadequate for dealing with power arcs, horns, and rings of very robust construction are being used.

On the initial lines the tension insulators consist of two strings of normal units in parallel, but consideration is being given to the use of single strings of units having an electro-mechanical strength of 20,000 lb.

(*To be continued.*)

Correspondence.

Correspondents should forward their communications* as early as possible.** ***No letter can be published unless we have the writer's name and address in our possession.

Thermal-Storage Water Heaters.

I am much indebted to Mr. Duncan Low for the interest he has taken in the figures I published recently relating to the consumption of off-peak water heaters,* but I am disappointed that he has not supported his criticisms with more comprehensive and more relevant data. For example, Mr. Low's Table III is quite without significance in relation to the Zurich figures. It refers to coal-fired boilers, and it covers a period of five weeks only. It seems to me quite wrong to introduce figures of this nature at all in a criticism of such carefully compiled results as those with which my article was concerned. Thermally, the coal-fired domestic boiler plant is an entirely different apparatus from a properly designed storage heater, and the habits which have been formed by its users in this country are due partly to its poor temperature characteristic and partly to the fact that the hot water is regarded as costing little or nothing to produce.

I should be interested to know the basis of calculation whereby Mr. Low arrives at the water consumption figures he gives in Table I, that is, the heater efficiency and the initial water temperature he has assumed.

With regard to Mr. Low's statement that the Zürich curves of consumption per person per day show a surprising fall as the number of persons in the family increases, I can only say that I do not agree with him. In the first place, these are curves of electrical consumption, not water consumption. One must therefore remember that the daily heat losses from the tank cause the consumption per person in small families to appear high. With larger families this loss is not only divided amongst the members, but also becomes definitely less. since the average temperature of the water during the day is less, consequent upon more frequent use. Furthermore, as Mr. Low suggests, a saving per person is made in the kitchen when the family is large. But this effect was shown in my article to be important, as the kitchen consumption represents between 30 per cent. and 40 per cent. of the total. It seems to me that one should expect a steeply falling curve, tending towards a constant as the family becomes very large, and this is exactly what the Zürich curves show.

Turning to the figures for four Glasgow houses which Mr. Low publishes (Table II), I find similar difficulty in reconciling my ideas with his. Apart from the fact that these results refer to only one heater of each type, which may or may not be important, no details are given of the period over which the results were compiled, the types or location of the storage tanks used, or the length of time or location of the service before the records were taken. Two of the houses are of eight rooms each (the Zürich results were all from smaller houses) and, of the four sizes of heater, only the 20-gallon one compares with the Zürich heaters, but that one was not an off-peak loading! I do not see, therefore, how a compari-

* "Thermal Storage Water Heaters," Elec. Rev., September 13th, 1929.

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son of consumption figures can be based on these results. Moreover, I cannot understand the reason for using heaters of the enormous capacities of 90 and 100 gallons in houses of 5 or 6 rooms, if only the ordinary domestic uses are involved.

I agree that storage heaters should not be too small, and, in fact, I said so in my article; but properly lagged tanks of a capacity much in excess of 25 gallons cannot easily be accommodated in the modern middle-class house, and their first cost is high.

Finally, I would say that in my remarks I do not wish to infer that Mr. Low is necessarily wrong if he considers that slightly higher consumptions than those shown by the Swiss curves would apply here. But the facts are that the Swiss figures were the result of a very complete investigation of records from a large number of families, all of the middle class. They are confirmed by a similar thorough investigation made in Germany, in a district remote from Zürich. My own observations tend to confirm them, and at present I do not see, on general grounds, why they should not be approximately correct for this country. Criticism of them is, of course, desirable, so long as the arguments put forward are also supported by a complete investigation, and are comparable with the Swiss results in other respects, but it would be a great pity if their value and importance were discounted by anything less than this.

L. G. A. Sims, M.Sc.(Eng.).

Birmingham,
September 28th, 1929

Work for the Unemployed.

I have read with much interest the article by Mr. A. W. Willsmore under the above title, in your issue of September 20th. I am particularly glad to see that he regards increased production as the one and only means of increasing the standard of living in the country. As he puts it, "Without an increase in production, devices such as increasing monetary wages, with a view to improving the living conditions of the workers, are futile."

But how, it may well be asked, is it economically possible to increase production when the existing unemployment indicates an excess of production over demand? Mr. Willsmore replies that some "artificial stimulus to demand" must be found, and he enumerates some possible stimuli, only to damn them with faint praise, and, personally, I feel quite rightly so. To borrow his expression once more, they are "futile." I am somewhat surprised, however, that Mr. Willsmore does not allude to what, in my view, is the only practicable stimulus to demand, i.e., the more general purchase of goods made in this country. I think the omission may be due to Mr. Willsmore's desire not to touch upon a subject which has so unfortunately become "political." The purchaser of a foreign-made article excuses himself upon the comfortable theory that it is immaterial whether an article is imported or made at home, since, in the former case, it will be paid for by some other article made here. It is further argued that the only result of refusing to purchase foreign-made articles would be to transfer labour from the making of goods for export to the making of goods for home consumption, so that no one would be any better off.

This argument overlooks two facts, (1) owing to the low price level of our competitors in foreign countries, we frequently have to export the equivalent of at least one-and-a half articles in exchange for every one which we import, and (2) when there is chronic unemployment in the country, the purchase of home manufactured articles does not result in the transfer of operatives from export to home work, but from idleness to production.

To simplify the problem, let it be assumed that we are importing from abroad all that is required to support our million unemployed. Then, clearly, in order to pay for these imports, we must export the produce of almost another million operatives. If, on the other hand, the unemployed could be put to work, they would become self-supporting and the product of the other million operatives, instead of being set aside to pay for their keep, would go towards raising the standard of living of the country.

However convincing may be the argument for a *laisser-faire* attitude when employment is normal, few will be found to support it in the face of the present unemployment. The only question which really admits of argument, as it seems to me, is what is the best method of encouraging the purchase of home manufactures—— but I have already trespassed too far upon your valuable space.

K. Edgcumbe.

London, *September 27th*, 1929.

Domestic Wireless.

Mr. M. Codd's criticisms would excite more respect if he dealt only in technical facts and avoided ill-concealed antipathies. In his letter on my article, "Laying-on the Domestic Wireless," he cannot avoid this pointless and baseless thrust:—"For commercial expediency we are all shortly to be cursed with a.c. supply, to the detriment of our eyesight and general convenience." Later one finds traces of the same surprising attitude.

Mr. Codd does not like my suggestion that radio sets are bound to depend more and more upon the supply mains rather than upon batteries. Yet both logic and trading facts support me. He says that the bulk of B.B.C. subscribers use gas or oil, but I cannot comprehend or believe any picture of the future made in present-day terms and conditions. The growing dependence upon electric supply is surely undoubted, and it seems to me that in innumerable households the average set of the future will never require anything else than merely switching-on, and, perhaps, simple tuning. This does not mean the complete abandonment of batteries any more than that widespread electric supply will bankrupt all the candle factories.

Mr. Codd is unduly hypercritical of mains-drive apparatus. Properly-designed apparatus does not cause a "loud hum," nor do I think that the ordinary allowable voltage fluctuations matter. True, mains failure is not unknown, but surely it is infrequent; locally, the B.C.C. station has failed more often than the electric supply.

I regret, with Mr. Codd, that eliminators, &c., are relatively so dear; but I trust that these (and the host of conveniences, like vacuum cleaners and hair dryers) will one day attain to a really popular price.

G. E. Moore.

Benton, *September 23rd*, 1929.

My Electric House.

I am pleased to see in your current issue that I have an ally in Mr. W. A. Gillott, with whose remarks, concerning the necessity of members of the electrical profession using electricity more extensively in their homes, I am in entire agreement.

I was very interested in the notes on water-heater consumption contributed recently by Mr. L. G. A. Sims, but I would point out to him that I am fully aware that my converted hot-water system is by no means as efficient, from a consumption point of view alone, as a properly designed electric water-heater with thermostatic control. The main reasons why I adopted this particular method are capital costs and the considerable alterations to existing plumbing work, when installing such a heater, which would be necessary in order to obtain the same service of hot water at all outlets as was enjoyed under the old coal-fired system. I have discussed these considerations more fully in a recent article entitled "Immersion Water-Heaters" (Electrical Review, May 31st, 1929, page 956).

Reg. H. Rawll.

Birmingham, *September 24th*, 1929.

A Problem in Testing.

I wish to bring to your notice a question on testing which was set in a recent examination.

"Two telegraph lines are run between the same two stations and may be designated A B and A_1 B_1.

"A B develops a partial earth fault at C. B and B_1 are connected together and resistance measurements give the following results:—

"Between A and earth (B insulated), 206 ohms; between A and A_1 (B insulated)), 520 ohms; between A and earth (B earthed), 194 ohms; between A_1 and earth (B earthed), 290 ohms. Find the distance A C if A B=25 miles."

At first sight this seems an easy problem, but after having attempted it and getting almost to the solution, I find it becomes rather involved, which causes me to doubt if I have tackled it in the right way.

Perhaps your readers, especially those who are testing experts, may be able to solve it in a very simple way.

A. T. S.

September 29th, 1929.

The Kilowatt Hunting Season Starts.

The E.D.A. Conference on Friday dealt with most of the points required to help this good work forward. But neither the Conference nor the excellent literature issued by the E.D.A. referred to an item of helpfulness which, to a manufacturer, is of supreme importance in regard to selling goods, *i.e.*, the persuasive efforts of representatives whose technical knowledge enables them to be of service to possible customers.

I hesitated to bring this forward at the meeting, as, in the absence of the slightest mention of the point, I thought there must be some reason for its exclusion. As a result, however, of the (sometimes more valuable) informal discussion over the tea-cups afterwards, I now think that the subject may be worth consideration. The following, therefore, are some details of my suggestion for adding another item to the programme of the Outlet Campaign:—

Trained inspectors, men and women, to be employed either by the E.D.A. on a suitable arrangement with the undertakings concerned, or by the undertakings themselves, or by a combination of the various manufacturers interested in apparatus likely to be used.

Daily letters to be sent to a suitable number of consumers in the same street or district, advising that an electrical

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apparatus expert will call the next day to answer questions, and to give useful information about their installations, in case they wish to consider using additional apparatus.

Calls upon the local showrooms would be more likely to occur by such introductions, if the matters were not settled at the house.

An additional duty, which would be of value to certain undertakings where the "jerry" wireman had been rampant, might be to inspect and test the wiring and report on it, for the satisfaction or warning of those concerned, and to help to prevent further jerry work.

There is, of course, the question whether the scheme would pay, and that could best be decided by practical experiment. At first, no doubt, the going would be slow; but, as time went on, a greater number of people would be dealt with daily, with greater efficiency also.

Perhaps some of those connected with undertakings dealing with the problem in some such way will state their experience of it for the benefit of the Outlet Campaign.

J. H. C. Brooking.

Croydon,
September 30th, 1929.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken

1928.

6,715. "High-frequency telephone systems." J. J. V. Armstrong (Telefunken Ges. für Drahtlose Telegraphie). March 3rd, 1928. (318,557.)

7,111. "Impregnating paper for insulation of electric cables and apparatus therefor." C. J. Beaver and W. T. Glover & Co., Ltd. March 7th, 1928. (318,647.)

10,102. "Electric switches." J. A. Crabtree. April 4th, 1928. (318,559.)

12,971. "Electric accumulators." C. Croom-Johnson. May 2nd, 1928. (318,502.)

13,671. "Electro-optical cells for use in electrical picture transmission and television systems." L. Mellersh-Jackson (Siemens & Halske Akt. Ges.). May 9th, 1928. (318,654.)

15,423. "Electrically-operated and controlled vehicles." Igranic Electric Co., Ltd., J. Lucas, Ltd., A. H. Mackley, and J. W. Burleigh. May 25th, 1928. (318,475.)

15,688. "Sound reproducers." W. B. Whitmore. August 15th, 1927. (295,625.)

15,887. "Telephone systems." Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.). May 31st, 1928. (318,477.)

15,913. "Electric remote-control systems." British Thomson-Houston Co., Ltd. May 31st, 1927. (291,385.)

15,945. "Quick-acting regulator of the vibrating type for keeping the current or voltage of generators constant." Akt. Ges. Brown, Boveri et Cie. June 1st, 1927. (291,407.)

15,977. "Shock-absorbing mounts for thermionic valves or other electrical devices." Benjamin Electric, Ltd., and G. Campbell. May 31st, 1928. (Cognate applications, 27,190/28 and 19,133/28.) (Addition to 250,431.) (318,507.)

16,076. "Reproduction or amplification of sound waves." H. Green and Celebritone, Ltd. June 1st, 1928. (Cognate application, 4,271/29.) (318,564.)

16,105. "Systems and apparatus for television." J. E. Pollak (Associated Telephone and Telegraph Co.). June 1st, 1928. (318,565.)

16,419. "Signalling arrangements, particularly for use in telephone systems." Standard Telephones and Cables, Ltd. June 6th, 1928. (318,569.)

16,489. "Electrical heating apparatus, particularly for use with incubators." G. T. Church. June 6th, 1928. (318,574.)

16,618. "Electric traction for railways." S. M. Rutnagur. June 7th, 1928. (318,666.)

16,631. "Testing arrangements for electromagnetic relays or the like." Standard Telephones and Cables, Ltd., and S. Chapman. June 8th, 1928. (318,667.)

16,671. "Automatic overload control device." T. S. Ramsdell. June 14th, 1927. (292,126.)

16,676. "Methods of and means for driving films in sound-recording or reproducing apparatus." British Thomson-Houston Co., Ltd. July 5th, 1927. (293,381.)

16,677. "Brush holders for ignition dynamos." British Thomson-Houston Co., Ltd., F. A. Fossey, C. J. Morton, and T. H. Woodfield. June 8th, 1928. (318,669.)

16,703. "Ventilation of dynamo-electric machinery." Sir C. A. Parsons and J. Rosen. June 8th, 1928. (Patent of addition not granted.) (318,671.)

16,706. "Electric-disturbances neutraliser for radio communication." A. H. Marks and P. Russell (legal representatives of E. C. R. Marks, deceased) (H. N. Jasper). June 8th, 1928. (318,672.)

16,715. "Adjustable high-ohmic resistances and the method of manufacturing the same." J. Kremenezky (trading as J. Kremenezky (firm of)). March 31st, 1928. (308,749.)

16,724. "Train-control systems." Associated Telephone and Telegraph Co. August 17th, 1927. (295,679.)

16,986. "Electrically-operated bolts or fastenings." H. Garner and G. H. Mulley. June 12th, 1928. (318,677.)

17,026. "Variable condensers and radio-receiving and the like apparatus incorporating variable condensers." E. J. Wyborn. June 12th, 1928. (318,679.)

17,052. "Arrangements for mounting equipment of the kind used in telephone systems." Automatic Telephone Manufacturing Co., Ltd., F. Kessler, and C. R. Woodland. June 12th, 1928. (318,681.)

17,155. "Buoys or similar signalling stations fitted with acoustical signalling apparatus." J. Pintsch Akt. Ges. June 14th, 1927. (292,128.)

17,283. "Electric signalling apparatus." Igranic Electric Co., Ltd., J. Lyons & Co., Ltd., S. R. Wright, A. Goddard, and G. Douglass. June 14th, 1928. (318,683.)

17,681. "Electric switching systems controlled by timing apparatus." E. Boder. June 23rd, 1927. (292,603.)

17,837. "Holder for incandescent strip electric lights." H. C. Pride. June 20th, 1928. (318,690.)

18,066. "Coupled electric inductance coils." E. H. Chapman. June 22nd, 1928. (318,693.)

19,703. "Electrical heating devices." I. N. Whitesmith, J. A. Dorratt, and Associated Electrical Industries, Ltd. July 6th, 1928. (318,702.)

20,097. "Welding of rails or the like by means of super-heated molten metal." Elektro-Thermit Ges. and A. G. Crum. July 10th, 1928. (318,705.)

20,211. "Telephone sets incorporating manually-operated selectors." Siemens & Halske Akt. Ges. September 22nd, 1927. (297,454.)

20,392. "Electrical sound-producing device." Consulting and Radio Service, Ltd., and N. Turner. July 13th, 1928. (318,708.)

20,894. "Electrical circuit interrupters." Associated Electrical Industries, Ltd. July 27th, 1927. (294,605.)

21,898. "Switchboards." G. T. McGlashan and G. S. Clark. July 28th, 1928. (318,716.)

22,460. "Thermionic valve circuits." H. L. Kirke, B. N. Maclarty, and T. C. Macnamara. August 2nd, 1928. (318,726.)

22,937. "Electrically-heated vessels and the like." T. M. Harrison. February 10th, 1928. (305,643.)

23,224. "Electric heater." H. G. Landis. August 11th, 1928. (318,728.)

24,001. "Cells for the production of gases by electrolytic processes." A. Lane. August 21st, 1928. (318,734.)

24,444. "Lamps, particularly head lamps, for motor vehicles." E. Bienner. September 24th, 1927. (297,672.)

24,739. "High-speed synchronous motor combined with a gear-wheel transmission gearing for driving clocks, and for the control of tariff apparatus of all kinds." Allgemeine Elektricitäts Gesellschaft. September 23rd, 1927. (297,456.)

25,504. "Electric current transformers for use in electric switchgear installations." Siemens-Schuckertwerke Akt. Ges. November 5th, 1927. (300,117.)

28,415. "Sound-reproducing devices." C. French. October 3rd, 1928. (318,766.)

30,239. "Railway and tramway switchboxes or ground levers." S. S. Wrightson and C. R. Matthews. October 19th, 1928. (318,781.)

30,988. "Electric circuits, including smoothing elements." Mullard Radio Valve Co., Ltd., and P. W. S. Valentine. October 25th, 1928. (318,785.)

33,325. "Arrangement for switching off loads on very-high-tension electric nets." Siemens-Schuckertwerke Akt. Ges. November 24th, 1927. (301,078.)

35,331. "Current transformers." Allmanna Svenska Elektriska Aktiebolaget. February 17th, 1928. (306,117.)

1929.

25. "Train-control systems." Associated Telephone and Telegraph Co. August 17th, 1927. (Divided application on 295,679.) (303,415.)

26. "Train-control systems." Associated Telephone and Telegraph Co August 17th, 1927. (Divided application on 295,679.) (303,416.)

1,151. "Globe fittings for electric lamps." W. McGeoch & Co., Ltd., and C. W. Fraser. January 12th, 1929. (318,817.)

1,200. "Shock-absorbing mounts for thermionic valves or other electrical devices." Benjamin Electric, Ltd., and G. Campbell. May 31st, 1928. (Cognate applications, 35,652/28, 2,185/29, and 2,186/29.) (Divided application on 15,977/28.) (318,575.)

2,066. "Potential supply devices for use with thermionic valves and the like." Telefunken Ges. für Drahtlose Telegraphie. January 20th, 1928. (304,614.)

9,966. "Indirectly-heated thermionic cathode." Dr. S. Loewe. June 25th, 1927. (Divided application on 292,923.) (308,823.)

17,951. "Electric switches." Associated Electrical Industries, Ltd. June 16th, 1928. (313,607.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from September 25th :—

Premag. No. 505,395. Class 1. Chemical substances used in manufactures, &c.—The Premier Electric Welding Co., Ltd., Harrow Manorway, Abbey Wood, S.E.2.

Davenset. No. 500,350. Class 8. Apparatus for transforming alternating current to direct current.—Hubert G. A. P. Wilson, trading as Partridge, Wilson & Co., 217a, Loughborough Road, Leicester

Phœbus (lettering and design). No. 503,011. Class 8. Radio gramophones, &c.—Apollo Gramophone Co., Ltd., 4-5, Bunhill Row, E.C.1.

Crolecto (lettering and design). No. 505,151. Class 8. Wireless telephonic apparatus in combination with gramophones.—Geo. Crossley & Son, Ltd., 4, South Street, Manchester.

Vaclam. No. 504,351. Class 13. Vacuum lamps.—The International Vacuum Power Co., Ltd., 34, Victoria Street, S.W.1.

Pedigree. No. 505,482. Class 13. Metal goods for use in electric lighting, heating, signalling and power installations.—J. A. Crabtree & Co., Ltd., Lincoln Road, Walsall.

Vinylite. No. 501,844. Class 50. Synthetic resin in slabs, sheets, bars and tubes for industrial purposes, and moulding materials made from synthetic resin.—The Carbide and Carbon Chemical Corporation, 30, East Forty-Second Street, New York, U.S.A. (British representatives: Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

Diesel Electric River Tugs.

At Nashville, on the Cumberland River in the United States, railway methods are being employed in modern river transport. Electrically-propelled towboats with a new caterpillar drive are being used to move large trains up and down the river. The small Diesel-electric towboats, which draw only about two or three feet of water, collect the barges from shipping points along the smaller streams, much as a shunting engine would do with railway trucks. The "train," or fleet of barges, is then towed to distant points by larger tugs of similar design. As the barge fleet travels up or down a river, one of the smaller tugs detaches a barge from the fleet and takes it to a dock, perhaps there picking up another barge and attaching it to the fleet, which is done without stopping the barge fleet. The Diesel engines on the smaller boats have a fuel consumption at full load of about three gallons of oil per hour, so that the fuel bill is approximately ninepence an hour only. The caterpillar drive on each side of the tugs consists of a chain with blades attached in a manner resembling the method of attaching buckets on a chain conveyor. Separate motors operate the two caterpillar drives. By reversing the drives, a boat can be turned round in its own length. No rudder is necessary, as the boat is controlled perfectly by the caterpillar drive. Because of their small draught, the smaller towboats can reach docks which have been unavailable to steamboats of deeper draught. Each barge can be loaded through side doors, or through panels in the roof. They are coupled together in long lines, either single file or two or three abreast. A special form of coupler is used which resembles couplers of railway carriages. Although the ends of the barges couple snugly together, the trains are quite flexible, and are capable of making sharp bends because of a movable pontoon at one end of each barge.

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

AYR.—Post office extensions, for H.M. Office of Works; architect, 122, George Street, Edinburgh (returnable deposit of £1 1s.).

BEDFORD.—Bank, Cauldwell Street, for Westminster Bank, Ltd.; Searle & Searle.

BEXLEY.—School (350 places), Gipsy Road, Welling, for Kent E.C.; director of education, Maidstone.

BRIDGWATER.—Housing scheme (56), for the T.C.; borough engineer (returnable deposit of £2 2s.).

BRIGHTON.—Houses (72), Bevendean estate; borough engineer. West Street improvement scheme; Lewis and Lewis, Victoria Street, Westminster, advisors for Corporation. Cinema, restaurant, &c., 75-9, East Street; Associated British Cinemas, Ltd. Shops (5), Mafeking Road; Charles Blaker. Rebuilding 179-180, Western Road (£12,223); Geo. Lynn & Sons, builders. Reconstruction, 193-4, Western Road, for Saxone Shoe Co., Ltd. (£10,600); borough engineer.

BRISTOL.—Houses (56), Speedwell estate; Tudball and Gregory. Houses (48), St. Anne's estate; A. W. Norris. Reconstruction, Dings area (£79,000); new roads, &c. (£750,000); private lock-ups, for aerodrome; city engineer.

BURNLEY.—Sewage disposal works (£125,000); borough engineer.

CASTLE-DOUGLAS (Dumfries).—Re-erection of Glenlair (mansion), for Major Wedderburn Maxwell.

CHELMSFORD.—Extensions, offices, London Road; Automobile Association. School, for St. John's district; Education Committee.

CHESTERFIELD.—Girl Guides' divisional headquarters, with lighting and heating work (£3,500); W. A. Derbyshire, architect.

CLEVELEYS (Blackpool).—Church and schools (£10,000); trustees, Congregational Church.

CLUTTON.—Electric lighting installation, Institution, for the Board of Guardians; J. Wayne Morgan, engineer, 9, Mount Stuart Square, Cardiff (returnable deposit of £2 2s.).

COVENTRY.—Extensions, Stoke school (£15,220), for the E.C.; T. Bates & Son, Ltd., builders. Aerodrome, Baginton; Cross Cheaping improvement (£70,000); city engineer.

CROYDON.—Extensions, Coloma Secondary Schools, with assembly hall to hold 700, for the borough E.C.; director of education.

DROITWICH.—Housing scheme (40), for the T.C.; C. T. Butler, borough surveyor.

DUDLEY.—Shops (7) and offices, Union Street; H. L. Builder.

EASEBOURNE (Sussex).—Electric lighting installation Parish Church (£275); vicar.

EASINGTON.—Mining centre; Durham County E.C. and Miners' Welfare Committee.

EDINBURGH.—Filtration, &c., works, Farmilehead, for Waterworks Department (£50,000); city water engineer.

EWELL (Surrey).—Houses (250), for the Allied Building Corporation.

FALKIRK.—School (£60,000); executive officer, Stirlingshire Education Authority.

GRIMSBY.—School, Nunsthorpe (£30,200), for the borough E.C.; R. M. Phillips, builder, Brigg. Extensions, Scartho Hospital, for the Corporation (£26,845); H. Gilbert Whyatt, borough engineer and surveyor.

HARTLEPOOL. — Extensions, Henry Smith School; governors.

HAYES.—Wesleyan hall (£15,000); Somerford & Sons, contractors, Clapham.

HULL.—School, Flinton Grove, for the Hull Education Authority; city architect, Guildhall.

IRISH FREE STATE (Ardee, Co. Louth).—Mental hospital, for the Louth County Council (£65,000).

(Malloy (Co. Cork).—Alterations and improvements at County Home (£9,650), also alterations at the Fermoy District Hospital (£4,650); North County Cork Board of Health and Public Assistance.

(Tullamore).—General hospital; J. F. Mahon, secretary, Board of Health.

KINGSTON-ON-THAMES.—School clinic and offices, for the borough E.C.; borough surveyor (returnable deposit of £2 2s.).

LIVERPOOL.—Council schools, Highfield estate, Broadgreen, and at Whitefield Road; director of education, Education Offices, Sir Thomas Street. Clinics, maternity and child welfare centre, Clifton Street and Norris Green; city medical officer of health.

LONDON (Barking, E.).—School, Upney Farm estate (£46,146), for the E.C.; education architect.

(Hackney, E.).—Factory, 92, Southgate Road; A. J. King, Ltd. Alterations and additions, Kenninghall Cinema, Lower Clapton Road; Kingsland & Sons.

(East Ham, E.).—Secondary school for girls. White House site, for the E.C. Shops (5), Romford Road; H. Johnston. Factory, Barking Road; W. Allison. Remodelling South Hallsville school (£45,000) and senior school, Canning Town (£55,000), for the borough E.C.; education architect.

(Leyton, E.).—Public wash-houses (£14,500), for the T.C.; borough surveyor.

(Hornsey, N.).—Motor service station and lock-ups, Tottenham Lane; Humphries Hollom, Ltd.

(Catford, S.E.).—New premises, 122 to 126, High Street; Bovis, Ltd. Additions, 229 to 303, Hither Green Lane; Kinnear, Moodie & Co.

(Lewisham, S.E.).—Houses (187). Bellingham Farm estate; A. J. Glock, Ltd. School, Downham estate, for the L.C.C.; J. G. Stephenson. School, Riddons Road; J. W. Ellingham, Ltd.

(S.E. and S.W.).—Premises at Tooting, Abbey Wood, Camberwell New Road, Rye Lane, and Rotherhithe, for Royal Arsenal Co-operative Society; S. W. Ackroyd, Commonwealth Buildings, Woolwich.

(Wimbledon, S.W.).—Development, Pollard's Field estate; A. Aitkinson. Alterations, Princes Cinema, Merton Road; W. J. King. Additions, Wimbledon Hospital, Thurstan Road; R. J. and J. S. Thomson. Extensions, 98, High Street; Westminster Bank, Ltd. Additions, High Stevenson's works, Riverside Road; Jas. Burges and Co., Ltd.

(Fulham, S.W.).—Additions, Fulham Picture Palace, North End Road; Brewer, Smith & Brewer, architects, Richmond. Cinema, Fulham Road; Yates, Cook & Darbyshire, architects.

LOWESTOFT.—New premises and extensions, for Co-operative Society; society's architects.

MANCHESTER.—Paramount Theatre, for the Famous Lasky Players, Ltd.; J. Gerrard & Sons, Ltd., builders, Swinton, Lancs. Public swimming baths, Barlow Road, Levenshulme (deposit £1 1s.); city architect, Town Hall.

MANSFIELD.—Extensions, with electric lighting, at Brunt's School; Vallance & Westwick, architects, White Hart Chambers, White Hart Street.

NORTHERN IRELAND (Newry, Co. Down).—Installation of electric lighting at Town Hill and Technical School; electrical engineer and manager, Municipal Electricity Works, King Street (returnable deposit of £2 2s.).

OXFORD.—Houses (42), Green Road; Ives & Rushby. Repair shop, destructor plant, &c., Cowley; Morris Motors, Ltd. Waterworks, Beacon Hill; R. E. Tickel, resident engineer.

ST. HELENS (Lancs.).—Additional housing scheme (300), for the T.C.; borough surveyor.

SOUTHPORT.—Senior school, Birkdale (£21,700); director of education.

SUNDERLAND.—Central school; Education Committee.

TAUNTON.—Market hall, for the T.C.; Stone & Francis, architects, Lloyd's Bank Chambers (returnable deposit of £1 1s.).

WEST STANLEY.—Two schools (£68,000); Durham County E.C.

WHITEHAVEN.—School (400 places), for the borough E.C.; J. S. Stout, architect.

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DEC 1929

The ELECTRICAL REVIEW

FOUNDED 1872

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The
Electrical Review

VOL. CV. OCTOBER 11, 1929. No. 2,707

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Supply Engineers and the Grid.

REFERENCE was made in the Weir Report to the pernicious, but widely-held, view that less skill is required to manage an undertaking receiving a bulk supply than one operating a power station. We cannot help thinking that this view owes its origin, in part, to a false etymology. Often to the lay mind an engineer means a man who looks after engines; the inference is drawn that, if the engines are dispensed with, the engineer should be superfluous. This idea is akin to the vulgar error in supposing generating costs to be the only appreciable factor in determining the price to be paid by the consumer.

That the duties of the chief engineer and manager should be confused by the public with those of his station superintendent would be of little moment, if the representatives of the public were better instructed in the system of organisation for which they are ultimately responsible; as it is, the ignorance shown by some on this point is likely to be highly detrimental to the future of electricity supply.

A protest against the view referred to is raised in the September report to members of the I.M.E.A. in an article reproduced this week in our "Notes" section. It is there mentioned that undertakings, whose stations have been closed down, have reduced the salaries offered when making new appointments (and we would add, if we may do so without unfairly prejudging future actions, that the end of the wedge is thin). The fear is expressed that many of the best engineers will eventually be forced out of municipal employ, and this is an aspect of the position which Mr. Frank Hodges evidently overlooked when, at the I.M.E.A. annual dinner in June, he prophesied as promising a future for municipal as for company engineers.

The fact is, as the article points out, that the major engineering problem in connection with the supply of electrical energy lies in the reduction of distribution costs. Moreover, the capital spent on mains is appreciably more than that spent on power stations, while 62 out of every 100 men employed in supply work are engaged on work other than generation; in either case the disproportion is rapidly increasing.

But neither generation nor distribution is an end in itself. Statutory powers, as the Weir Committee reminded us, are given to authorised undertakers to supply electricity, and from that point of view its generation is of no more consequence than—to go one link back in the chain—the production of the coal used for raising steam. The supply engineer's primary duty is, therefore, to supply electricity, and his duties will

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involve, to an ever-increasing degree, the highly technical study of methods of meeting the diverse requirements of industry and social life.

If the arguments against reducing the status of engineers of distribution undertakings are not accepted now, there is at least a possibility that they will be at a later date, when it may occur to "economists" to inquire whether the operation of a power station, with the assistance of a skilled generating staff, justifies a salary in excess of that paid to the managing engineer with no station.

So far we have tried to present the case for the individual, but there is another and even more important case—that of the nation. Whatever personal views may have been held concerning the legislation of the past few years, all meet on common ground in the belief that every effort must be made to ensure the success of the supply section of the electrical industry under the new *régime*, now that the Act of 1926 has become the law of the land.

The Central Electricity Board can require the closing down of a station only if a substantial saving can thereby be effected. There are bound to be many instances in which the margin is small, and it will manifestly be to the advantage of the scheme as a whole, and probably also to the undertaking itself, if the latter will agree to take a bulk supply without recourse to the delays and appeals which the Act, in order to avoid any semblance of injustice, allows.

The co-operation and good-will of the municipal electrical engineer will often be the deciding factor, but, if he be haunted by the fear of professional relegation, is it not asking too much of human nature to expect his views not to be subconsciously biased?

Even if it is true to say that this is the age of machines, the human factor is still, as indeed it always will be, the most important element in successful working. If many of the best engineers decide to find an outlet for their energies in other fields and are succeeded by less able men, while others of the right calibre who remain are allowed to become discouraged by the thwarting of their proper ambitions, then no matter what improvements are brought about in mechanical and electrical efficiency, they will not be enough to offset the deterioration in personnel.

There may be no direct legislative power to deter those local authorities who wish to do so from adopting a short-sighted policy in regard to the staff of their undertakings, but it is to be hoped that indirect pressure can be brought to bear to prevent injustice and also, it may be, national loss.

Government and Foreign Trade.

Several years ago when experience proved that the Foreign Office and its representatives abroad did not lend any particular weight to our overseas trade expansion efforts; also that the Board of Trade acting alone was unable to render all the assistance that was required by our manufacturers; the Department of Overseas Trade (Development and Intelligence) was formed for the purpose of acting as a liaison committee to collect the information that was available and serve it up more speedily and in a form more suitable for the purpose of the trader. That it has done good work in the past we have frequently asserted here; its good service continues to-day, but we are awaiting the fulfilment of the Government promise to help in the expansion of trade by some form of reorganisation. We find it somewhat difficult to understand why the National Union of Manufacturers (Inc.) has had to ask the Government to form a new trade branch of the Foreign Office, unless the liaison arrangement referred to above has failed. The National Union is in doubt whether the Foreign Office, or the Government itself, is giving an adequate degree of assistance to British manufacturers in their endeavours to obtain competitive orders in foreign countries, or whether such assistance, if being given, is rendered in the most effective way—for example, when inquiries are being made for contracts for the making of dams and other general utility work. What the Union members ask is that there shall be made available for their use an experienced trade branch situated in the Foreign Office itself. The Union is fully sensible of the valuable work of the D.O.T., with which it supposes that the proposed new branch of the Foreign Office would work, in promoting business abroad, but it feels that the Foreign Office and its ambassadors should take a more active part in promoting our trade interests, and make greater efforts to secure orders in foreign countries. Excellent as these suggestions may sound, they will be replied to by a Government which has in its archives all the earlier history, part of which we have referred to at the beginning of these notes. It is not less necessary, but more, nowadays, that information of an official character to assist traders should be served up "hot," instead of being delayed because of double handling of news. If that is the object of the Union it is a good one.

20-kV Cable Vertically Installed.

It is a British characteristic to avoid mention of a new development until it has been brought to a successful issue. This self-imposed restraint may account in some degree for the criticism often levelled at our manufacturers in regard to inadequate publicity, but it nevertheless helps to build up a name for ability to back assertions by established fact, and probably proves beneficial in the long run to the national reputation for reliability and sound design. Thus there need be no surprise at the fact that the first announcement of the installation of a mile and a half of 20-kV cable, nearly two-thirds of which are run vertically, should appear in the *Transactions* of the South African Institute of Electrical Engineers after proof of the reliability of the cable over several months had been obtained. This cable was put into service last February, and, as a result of the experience gained, a further installation of 20-kV cables on the property of the East Rand Proprietary Mines was tested and handed over in August.

The economies due to this departure will be obvious, in view of the heavy electrical demand in these mines—a demand that had previously to be met by 2,000-volt cables.

The construction of a satisfactory 20-kV cable of the ordinary type is not noteworthy in these days, but, we believe, the design of nearly a mile of cable at this voltage for vertical operation is something that has not been accomplished before.

It is also particularly encouraging, in view of international competition there, that South Africa should be the country in which this fresh example of British enterprise and skill has met with its reward.

We publish elsewhere in this issue some extracts from the paper by Messrs. W. Elsdon Dew and H. Denehy, which describes the special type of paper insulated cable made by Messrs. W. T. Glover & Co., Ltd., in which, it is claimed, the impregnating compound will not bleed. As a consequence, hydrostatic troubles are overcome without the necessity of employing any draining process during manufacture.

An Efficient Organisation.

The works of Messrs. J. A. Crabtree and Co., Ltd., which are described fully elsewhere in this issue, are an excellent example of what an "all-British" concern can be when the true British spirit is allowed to prevail. Unhampered by petty restrictions, the management, staff, and workpeople have gone ahead in a true spirit of works co-operation, and so brought the organisation to its present state of proficiency and efficiency. Works results and works "atmosphere" are very closely allied; one cannot leave after a tour round Crabtree's works with any doubt about that point, and the driving force which has been responsible for bringing about such a cheerful spirit of co-operation is deserving of any and all the fruits of the energies absorbed.

We congratulate Mr. J. A. Crabtree, the founder and head of the works.

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A Factory for Small Switchgear.

Some Impressions of a Visit to the Works at Walsall of Messrs. J. A. Crabtree & Co., Ltd.

IT is refreshing to find a factory in the industrial centre of England that is so conveniently situated as the works of Messrs. J. A. Crabtree & Co., Ltd., who evidently realise that an up-to-date factory, in addition to being close to sources of supply of materials, labour and demand, should also, if possible, have a pleasant environment. The factory is believed to be the largest in the country devoted to the manufacture of small switches and accessories. From the front of the works the country stretches for miles in green meadows and cornfields, and the shrubs and flowers round the works are what one would associate more with a public park than an engineering establishment. Due to the Lincoln works being located on the fringe of Walsall, labour has to be drawn from a wide area, and a specially chartered fleet of omnibuses brings the employés from the outlying districts direct to the works' gates. It has been found that this is greatly preferable to leaving them to come by cycle and on foot, particularly during the seasons of bad weather.

A bird's-eye view of the works, fig. 4, which was taken before the present extensions were well in hand, shows an excellent aspect of this modern factory. The ground area is over nine acres, and the floor space is over one hundred thousand square feet. When the extensions are completed, the floor area will be nearly 140,000 sq. ft. At the present moment, the firm has eight hundred employés, which number will be added to when the extensions are completed.

The first thing that strikes the visitor, at any rate, if he is an electrical man, upon entering the offices is the

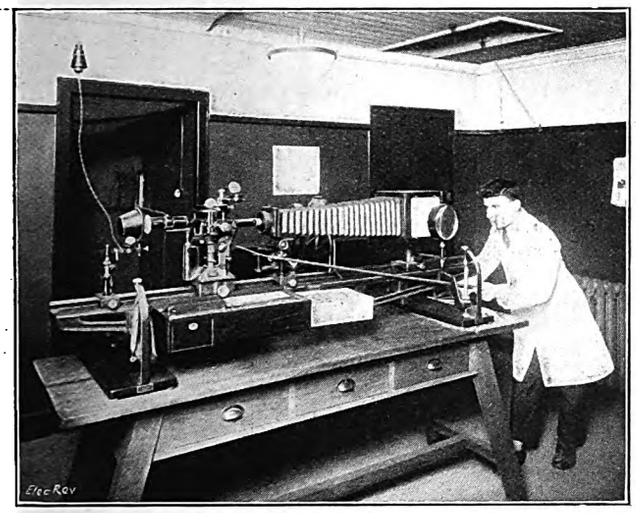

Fig. 1.—The Microscope Room.

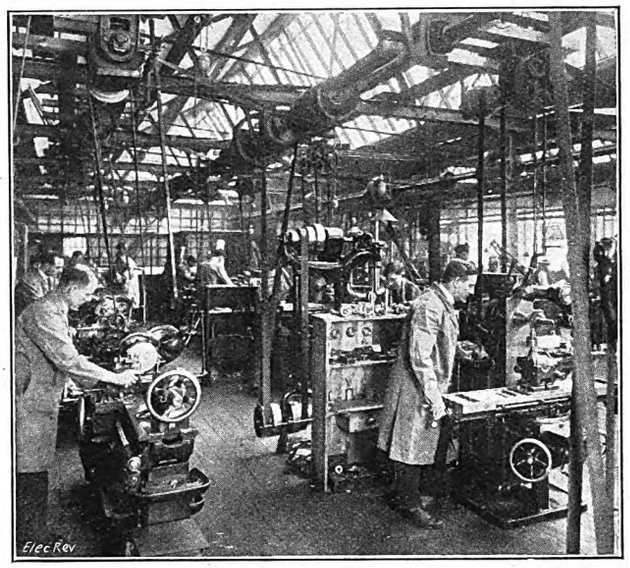

Fig. 2.—Tool Room; Machine Section.

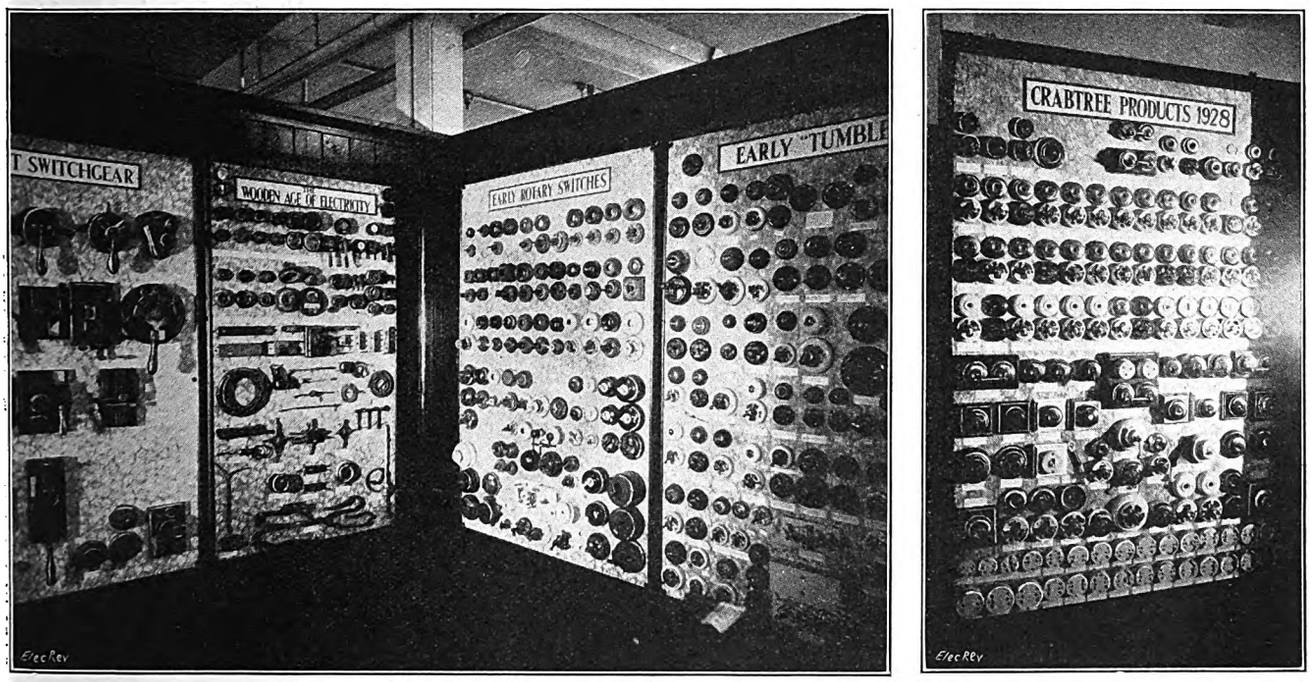

Fig. 3.—Ancient and Modern Exhibits in the Factory Museum.

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to reduce the insulation value to between 500 and 600 megohms. It was almost uncanny to see this effect, and to watch the needle resume its infinity position as the moisture film dried out, due to normal and osmotic drying.

At the time of our visit the moulding department was in the process of moving into a new building, and only a portion of the plant is shown in the view of the new section, fig. 7.

The firm's range of "Jacelite" products has met quite a market demand, and perhaps one of the most surprising features is that the surface mirror finish of the product is directly produced in the moulding operations by the extremely highly polished surface of the moulds. The moulding powders are inserted in the dies and these are placed in the hydraulic presses, which have steam-heated platens that are maintained at a definite temperature, according to the steam pressure employed in conjunction with pyrometrical control. Pressure is applied from a high-pressure pipe line to each press, and considerable advantage is obtained by utilising a special oil instead of water, which is the more usually employed high-pressure medium.

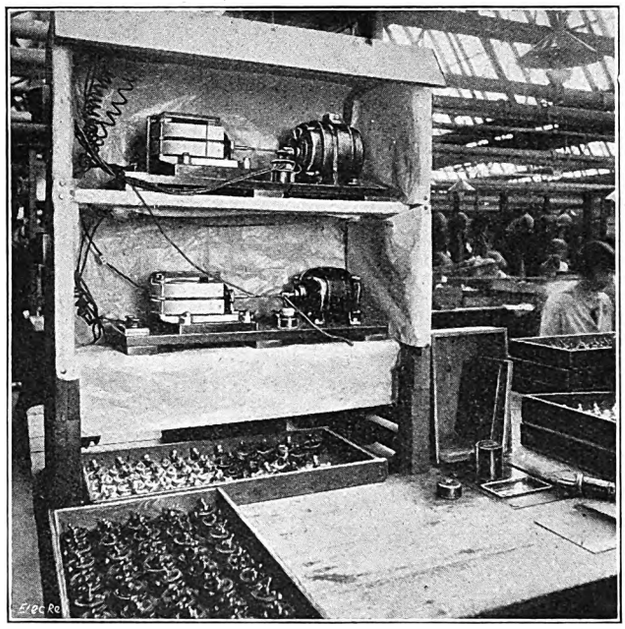

Fig. 11.—Insulation Testing Apparatus; 1,000 V.

Fig. 13 shows an electrically-driven three-throw vertical pump used in connection with the hydraulic plant.

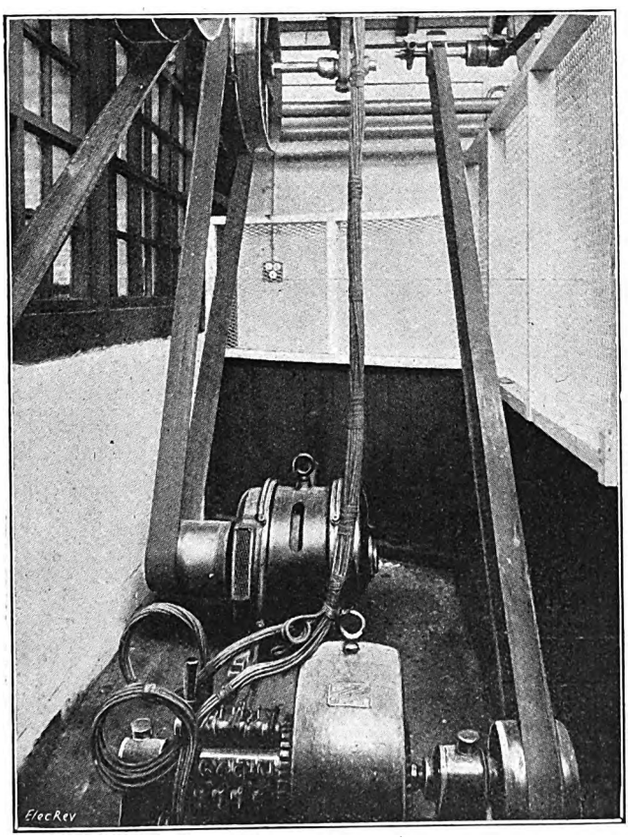

Fig. 12.—Three-phase Motor Drive and Low-voltage Generator.

The motor is controlled by a totally enclosed contactor-type starter, several ingenious automatic tripping devices being provided, so that the 80-ton hydraulic ram does not overlift.

In the automatic shop hundreds of thousands of screwed parts are required daily, and, as would be expected, a first-grade plant is employed for their manufacture. High-speed automatic machines have been installed for the accurate production of these small components. Screw threads to close limits can be cut at 3,500 r.p.m. When it is understood that the thread limits of a standard "Crabtree" terminal screw is required to be accurate within plus or minus one thousandth part of an inch in the thread diameter, and that considerably closer limits are required for pitch, it is easy to give credit to the workpeople concerned.

Drilling operations carried out at 14,000 r.p.m. without vibration would be of particular interest to the old-time mechanic, who had perforce to use much lower speeds.

As befits the general stores of a factory of this description, every mechanical facility is given for the efficient handling of the goods. In this connection it has been found that lead-acid batteries have given particularly good service. Possibly this is due to the lack of gradients, as the stores for each section are arranged for single-floor delivery.

With special counting machines at the disposal of the stores section, it is only a matter of a few seconds before a quantity of components can be rapidly determined. For instance, we found that it took only 7 or 8 seconds to determine that there were 9,860 components in a certain box selected by us.

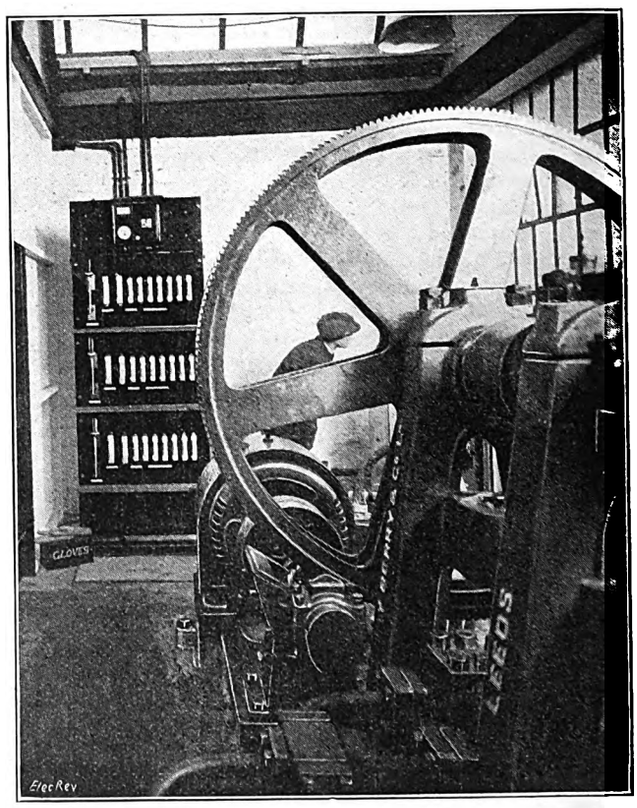

Fig. 13.—Three-throw Hydraulic Pump.

We were interested to find that there is quite a distinct fashion in metal colouring, and that certain finishes have their cycles of fashion, which also vary in different parts of the country. To meet all these requirements there is quite a large plant devoted to this stage of manufacture.

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For metal deposition, low-voltage current at 6 to 8 volts is taken from a low-voltage generator, shown in fig. 12, which is capable of delivering up to a normal load of 750 A. Current is conveyed to ring-main systems of ¾ in. thick solid copper rods, to which the vats are connected, each vat having an ammeter and rheostat, so that the current values can be regulated properly, based upon the total superficial area of the articles being plated.

Automatic polishing apparatus is employed for certain grades of finishing, where difficulty is experienced by hand work in maintaining equal pressure and definitely constant speed movements of the article, this being most essential if a first-grade finish is to be attained.

All tools are made within the works, and fig. 2 shows the well-equipped machine section of the tool room, comprising lathes, milling, shaping and drilling machines and precision grinding apparatus, each playing its part in the production of the all-important tools that must be so carefully designed and constructed when accurate products have to be produced in bulk. The power drive for the tool room is by means of two of the interchangeable 25-h.p. motors previously described, fig. 12, driving 2½-in. diameter shafting at 250 r.p.m. Compressed air for the heat-treatment annex is supplied by a blower driven from the main line shafting, the heat-treatment section being devoted to recuperative tool steel annealing, and the hardening and tempering of tools, a gas heated muffle being employed for the purpose, reaching the high temperatures required for the treatment of the high-speed and other special steels employed, the temperature being determined and controlled by thermo-electric pyrometers.

A well equipped cabinet shop for the production of distribution-board cases, and so on, is now in full swing, and automatic turning lathes, moulding, planing, and surface grinding apparatus are turning out what may be called first-class examples of the wood-workers' art. The same care and attention to detail that is exercised in the manufacture of "Crabtree" accessories is also apparent in the ironclad switchgear shop, where every facility for the manufacture of high-grade products upon the most modern manufacturing lines exist. Batteries of multi-spindle drilling machines are employed for the economic jig drilling of huge quantities of grey-iron castings, which are conveniently conveyed by means of roller conveyors to the sections concerned, each product after and during assembly undergoing electrical and mechanical efficiency tests to ensure a trouble-free product.

The inspection department is an interesting section, as here all the work previously carried out is carefully scrutinised, and any necessary final adjustments are made. Every screw is again tested, and every nut is again tightened. After a sequence of such tests each switch again withstands a 1,000-volt insulation test, and unless the insulation is greater than 1,000 megohms it is rejected.

There is a healthy sports club, cricket, football, net ball, tennis, and bowls being played. Several prizes are played for during the season, and the cups won are the pride of the individual departments. Not only is leisure provided for, but even ill-health. This often anxious and somewhat expensive time is met by a fund which is partly contributed by the employés.

In case of accident, an ambulance and rest room is provided, fully equipped for dealing with the minor accidents that are always likely to occur in a factory, a competent nurse being always in attendance.

In conclusion, we are indebted to Messrs. J. A. Crabtree & Co., Ltd., for their permission to view the works and take photographs, and to Mr. B. G. Harrison, technical manager, for his assistance in the collection of the above information.

Electricity Meter Jewels.

Some Observations which Point to the Need for further Research on Bearing Materials.

By A STATION ENGINEER.

EVERY industry hangs on something or other which is taken for granted and hardly ever talked about until some day the stresses increase and the unknowns come to the surface and demand research. For many years lubrication was just a question of a greaser with an oil pot, but duties increased, the Michell thrust bearing came into being, people began to see that Osborne Reynolds was something more than a ridiculous theoretical lunatic, and lubrication became a science worthy of expensive research. The same thing happened with steam boiler feed water and vacuum. The old engineer thought a 26-in. vacuum more than enough, and he was content if his feed water was reasonably clean, but now we use high vacua and feed water free from oxygen, and many other things which Old Bill considered fads and fancies. The electrical industry is specially open to the discovery of weaknesses. It is a thing of shreds and patches, of strings and tapes and waxes, and of items which would have made the old steam engineer jeer with contempt, but it does astonishingly well in spite of all that.

Among the "contemptibles" which mean so much to the industry are the jewels which support electricity meter pivots. Years ago makers were able to demand and obtain the finest quality of jewels, but to-day jewels are required by the million, and the quality has suffered accordingly. Synthetic jewels have come into being, not because they are wanted, but because there are not enough of the others to go round. The synthetic jewel suffers from weak spots, which render it liable to crack and to slow down the meter and reduce the revenue. The diamond jewel looks promising. It is hard, and diamonds are really plentiful; indeed, diamond mines complain that they are too plentiful. In the recent Institution of Electrical Engineers discussion* on Mr. J. L. Carr's meter paper, Mr. C. H. W. Gerhardi stated that he had used diamonds for fifteen years and had not found one defective jewel or pivot out of thousands in use. This is a very important statement, on which one would like to hear opinions from other authorities. Some people may object to the cost of diamonds, but what does that matter when the meter is measuring electricity worth, say, £100 a year, or much more? On the one hand, Mr. Gerhardi stated that some pivots bearing 25 gramme rotors had made as many as 300 million revolutions on their diamonds and were apparently as perfect as at the start. On the other hand, Mr. E. Fawssett stated at Newcastle-on-Tyne that he had found diamonds brittle and that the surface flaked off and destroyed the pivot. There may be a reason for this: diamonds are crystalline; indeed, in the course of manufacture a large stone is actually split up, as one might split a slate, and it is possible that the suitability of a diamond when used

* I.E.E. *Journal*. Vol. 67. No. 391, July, 1929.

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as a bearing in a meter may vary according to the way in which it is cut. The problem requires clearing up, as, if suitable, diamonds should do much to solve the meter problem.

The pressure per square inch on a pivot is prodigious, amounting to from 40 to 50 tons per square inch. The odd thing is that mercury meters, in which the weight of the rotor is partly borne by the mercury, suffer quite as much jewel wear as others. Much work has been done on ball bearings for meters, the rotor being carried by a steel ball instead of by a pivot, but experience does not appear to favour them. Perhaps the reason may be seen from the diagram: the ball is shown in a cupped jewel and it would seem that the bearing surface is not a point contact, but that appreciable areas are in contact. If this is the case, there will be a difference between the friction near the centre and that further away from the centre of the support, which will produce uneven wear. After a time the skin will wear off the steel ball and then it will get out of shape, after which deterioration will be rapid. There is great discussion as to the desirability of lubrication, but on the whole opinion seems to be against it. If the oil becomes sticky, it will have a bad effect; a dry bearing appears to be better.

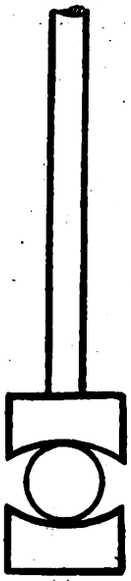

Fig. 1.—Meter Ball Bearing.

Testing by running meters millions of revolutions is not very satisfactory. We have to remember two things, friction and stiction. Stiction acts when surfaces are in contact without movement, when they tend to weld together. When movement begins the molecules at the surface are torn off and in time the surface is damaged. A pivot that is always running may suffer less wear and tear than one run an hour or so each day. Even stationary pivots are not free from wear in a.c. meters, as the rotor is always vibrating, and cases have been recorded in which jewels have cracked when the meter was kept alive on the shunt coils, although not turning round. A further important point which requires attention is the coefficient of friction between the two surfaces in contact. The experiment has been made of using one jewel for the cup and another for the pivot; great results were expected, but not realised. One has only to try rubbing one piece of smooth glass on another to see that good results should not be expected from so doing, as the friction between glass and glass—and presumably between jewel and jewel—is very great. It is probable that work along these lines might disclose the fact that the coefficient between some kind of jewel and some alloy of metal is particularly low, and that such a combination might prove to be the solution of the problem. One has only to refer to the work of motor-car engineers with cylinders and pistons to see how important is the problem of friction coefficient. More hardness is not enough where surfaces are rubbing against each other.

The subject requires microscopic research, microscopic in the literal as well as in the figurative sense. It is well to remember that while the effects are microscopic to the research man, they are megascopic to the Accountancy Department! Research work needs money. Some generous buyers think that all research should be paid for by manufacturers, but after all it is the buyer of meters who wants accuracy far more than the manufacturer. Let users pay up like good engineers and like good commercial men. Research is not an expense, but a method of making money.

Flaxman Telephone Exchange.

Brief descriptive details of the automatic switching equipment installed in London by the General Electric Co., Ltd., for the Post Office telephone authorities.

THE opening of the Flaxman telephone exchange marks another step towards the completion of the London director automatic telephone system. It is one of the few fully equipped 10,000-line automatic exchanges so far installed in the London area, and serves the Chelsea district.

The equipment is installed in a large four-storied basement building in Mallord Street, the pleasing appearance of which bears witness to the real efforts of the officials of the British Post Office to preserve the amenities of the district by choosing a style of architecture which will harmonise with the existing houses. The basement of the building is used for stores, &c., and the ground floor contains the offices of the various officials responsible for the operation of the exchange. The first, second, and third floors, having a total area of over 18,000 sq. ft., are devoted to the exchange equipment.

The latter includes 9,900 subscribers' line circuits and 1,294 final selectors, mounted on 99 line units and one p.b.x. rack. In addition to the 822 first numerical and 640 second numerical selectors (fig. 2) for handling the local and incoming traffic, the exchange is equipped with 664 first code selectors and A digit switch finders, 405 second code selectors, 84 A digit switches, and 180 directors for dealing with calls local and outgoing to other exchanges on the system. An interesting feature of the Flaxman exchange is the use of selectors having

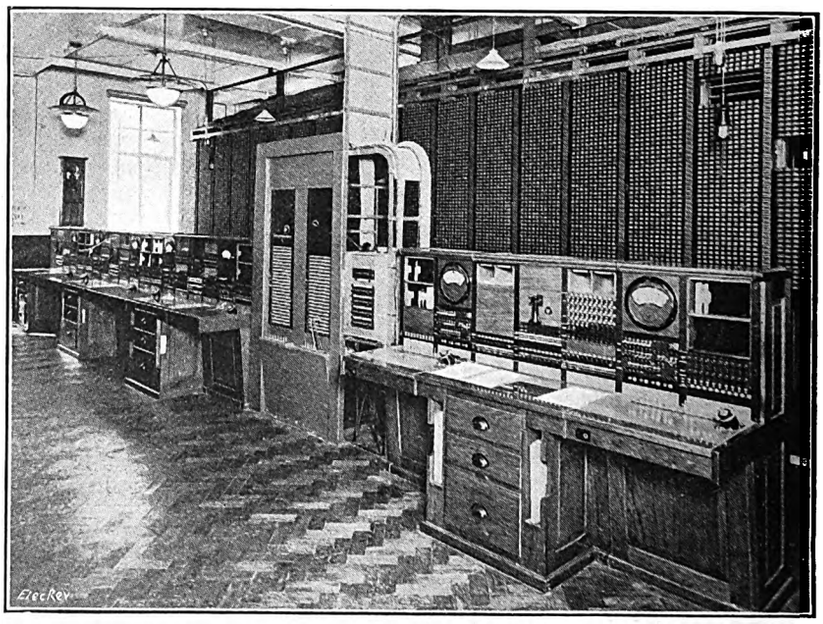

Fig. 1.—Test Desk and Meter Rack.

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twenty outlets on each level, which, in addition to reducing the number of switches required, enables a better grade of service to be given, as each call has access to

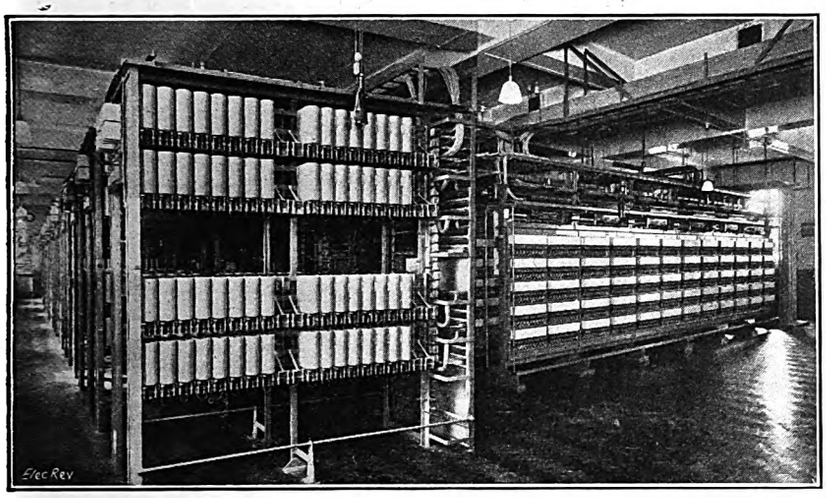

Fig. 2.—Second Numerical Selectors and Line Units.

twenty switches in the next rank. Switches of this type are used practically throughout the equipment.

A number of routine testers, or "routiners" as they are termed (fig. 5), are provided for applying tests automatically to each of the main pieces of apparatus in turn, thus ensuring that they are maintained in good working order and that the possibility of breakdown in service due to mechanical or electrical faults is reduced to a minimum.

Fig. 3.—Manual "A" Switchboard.

In addition to the automatic switching equipment, two manual switchboards (figs. 3 and 4) have been installed on the third floor for dealing with inquiries and calls for which a special fee is charged, and for handling incoming traffic from manual exchanges. Such incoming traffic is received over 400 incoming junctions on a suite of cordless B positions (fig. 4) and is transferred by the operators to the automatic subscribers through key-sender equipment. Calls outgoing from the Flaxman exchange to manual exchanges have access to 404 junctions; 30 coders are provided to store the calls until an operator is ready, and to convert the digits dialled into special impulses to operate the equipment at the manual exchanges.

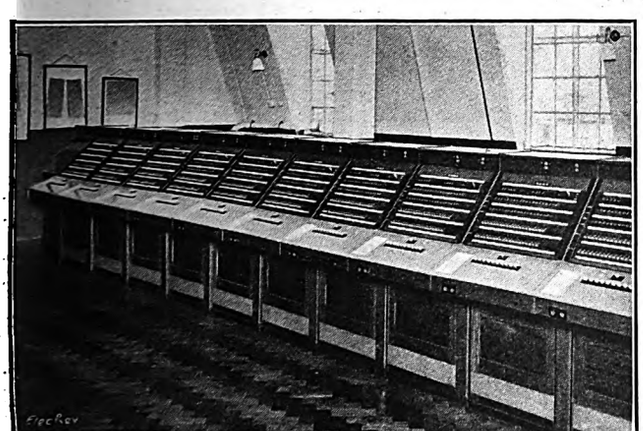

Fig. 4.—Cordless "B" Switchboard.

The power for operating the switching and speaking circuits of the exchange is derived from duplicate D.P. batteries housed on the first floor, which are charged by motor-generator sets installed in the first-floor apparatus room. The charging motor-generator sets are run off the 400-V d.c. mains and have a full load rating of 42 kW with a regulation of 50-57 volts. The current for ringing and signalling tones is provided by duplicate ringing machines, each having an output of 2 amperes at 75 volts; one set is driven by the battery and the other off the mains.

To ensure rapid clearing of faults and therefore continuity of service, a remarkably complete alarm equipment has been installed, which, by means of a system of coloured lamp signals, informs the maintenance engineer of a fault as soon as it develops and enables him to locate it with the least possible loss of time. Besides the lamp signals, which are primarily intended to facilitate fault location, audible bell signals are given when the fault occurs, and arrangements have been made to extend these signals to all other floors, so that the man on duty can be called from any part of the exchange to attend to them without delay.

An eight-position test desk (fig. 1) of the most modern design has been fitted, from which all subscribers' lines can be tested, and facilities are provided to enable the test clerk to get into communication with any subscriber on the exchange.

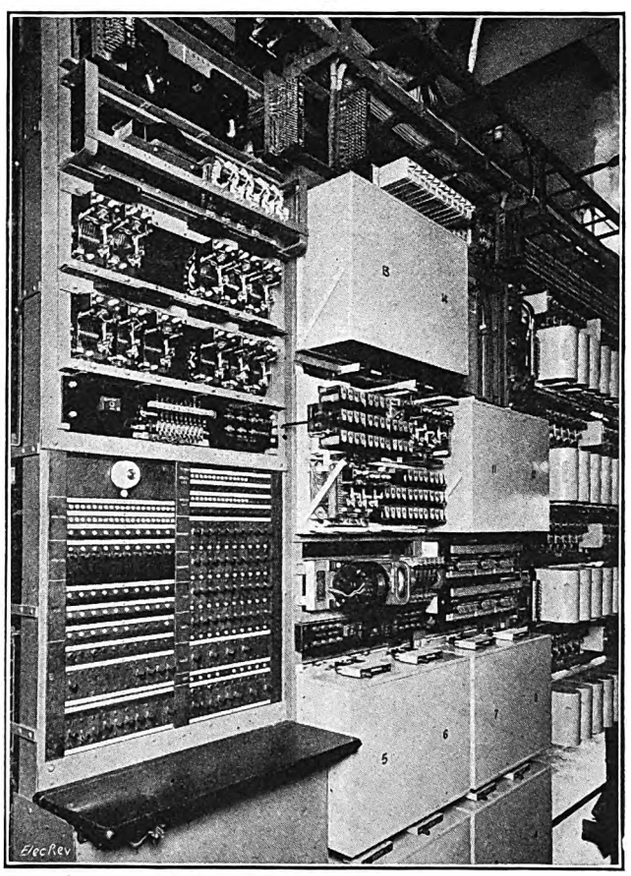

Fig. 5.—Key-sender Apparatus and Routiners.

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The whole of the Flaxman exchange equipment was manufactured and installed by the telephone works of the General Electric Co., Ltd., at Coventry, Warwickshire, the exchange having been opened for public service on September 14th. The cut-over was carried through without interference with normal service, or inconvenience to subscribers, and it is felt that those subscribers who are connected to the Flaxman exchange can look forward with complete confidence to really efficient service in the future.

20-kV Underground Transmission System of Crown Mines, Ltd.

Extracts from a Paper Read before the South African Institute of Electrical Engineers.

By W. ELSDON-DEW, M.Inst.C.E., M.I.E.E., Fel.A.I.E.E., and H. DENEHY, M.I.E.E., Assoc.A.I.E.E.

THE system described is an innovation in electrical engineering, of which, we consider, South Africa can claim to be the pioneer.

The subject of electrical transmission of energy underground in mines by means of super-voltage cables has been under discussion by the Engineering Department of the Central Mining and Investment Corporation, Ltd., for several years, mainly on the score of economy and line regulation. The matter was taken up with cable manufacturers, who, except in one or two instances, were not prepared, at that time, to put up a proposition to cope with the difficulties inseparable from the unique

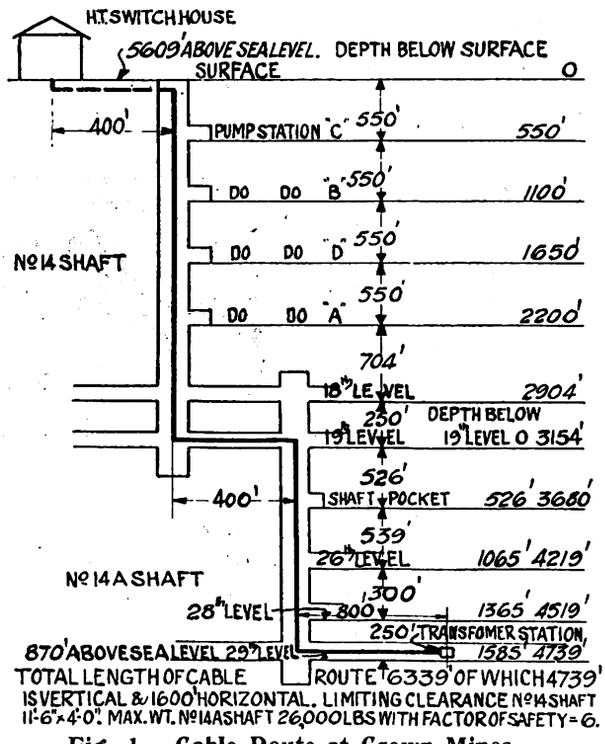

Fig. 1.—Cable Route at Crown Mines.

method of transmitting electricity at super-voltage by means of cables suspended in a vertical direction for distances of several thousand feet, and the matter was held in abeyance until two years ago.

In the interim, super-voltage transmission by cables had gained ground in Europe—it is the object of this present paper to describe our special conditions and to show the admirable manner in which they were met by the manufacturers.

The voltages that were adopted in 1909 for the various distribution services of the mines, *viz.*, 2,000 and 500 volts, were a distinct advance on the voltages previously in use in local mining work, but, in view of the greater depths at which mining is being carried on, the increasing use of electrical power for all purposes, and the greater distances involved, the use of higher voltages has had continued attention. It has only been possible lately, however, seriously to recommend the application of a definitely higher voltage (*e.g.*, 20,000 volts), as the advance in the art of manufacture of cables of this voltage for vertical shafts has not until lately been proved, either from the point of view of economy or of reliability.

The cable route at Crown Mines is shown diagrammatically in fig. 1, but the actual length of cable is 7,400 ft. (approximately) from the switch house at the surface to the transformer station on the 29th level.

Theoretically, it may be shown that for a given percentage loss in a cable of given sectional area, the power that may be transmitted is proportional to the square of the applied voltage. In practice, owing to fixed temperature limits, it may be said, roughly, that for a given actual loss the power transmitted by a cable of given sectional area is directly proportional to the applied voltage.

Temperature limits and line regulation, in the case of a 2,000-volt supply would have necessitated an ultimate expenditure in cables, spread over a period of years, of about 25 per cent. in excess of the cost of cables and transformers actually installed. The line regulation in the two cases would be approximately the same, but the full load overall efficiency works out to some 3 per cent. in favour of the higher voltage.

The prevalent cause of super-voltage cable breakdown under normal working conditions is ionisation. Ionisation is the result of the presence of voids, moisture, occluded gas or air in the dielectric or in the filling materials between the cores, and may be due to several causes, some of which are bubbles between the layers of paper, loosely wrapped or creased papers, insufficient or improper impregnation, and impregnating compound unsuitable for the particular service required of the cable. For cables laid horizontally, 20 kV, as we know, is now regarded as quite a low voltage, but a different view must be taken when the cable is suspended vertically, as the possibility of movement of the impregnating fluids, due to hydrostatic pressure and the consequent formation of voids must be taken into consideration. It is obvious that the drained type of cable, such as we use for shaft work and for normal voltages, would be quite unsuitable for the pressure under consideration.

The drained cable is so named because all free impregnating fluid is drained from the dielectric after the impregnating process (which aims at filling the papers and interstices to the utmost possible extent) but before the lead sheathing operation. It follows, therefore, that the impregnating fluid drained out can only be replaced by air, which, for reasons already given, at once debars this type of cable for super-voltage service.

The behaviour of paper cable dielectrics under certain conditions is as follows:—

(*a*) The dielectric power factor of a given cable is sensibly constant up to a certain applied voltage, beyond which it increases with the voltage—the temperature being maintained constant. This increase in power factor is the result of ionisation or the breakdown of minute particles of occluded gases, &c., in the paper interstices or fillings, and in consequence the dielectric conductance increases.

(*b*) The voltage being maintained constant, the power factor at first decreases (to a minimum value at about 100 deg. F. for a periodicity of 50 cycles) and then increases with an increase in temperature, the pressure being maintained constant.

Reference should be made to an I.E.E. paper by Dunsheath,* in which he applies Maxwell's theory of absorption as a possible explanation.

(*c*) If a cable is heated and then allowed to cool, it is found that the power factor usually has higher values at corresponding points of pressure and temperature than it had before heating.

Mechanical distortion, in one form or another, has been advanced by some as the reason for this characteristic: dilation of the lead sheath resulting in permanent deformation, separation of the cores, minute separation of the papers and consequent enlargement of voids and so on, but the subject matter is a very controversial one, and reference to a recent series of articles (Electrical Review, January 18h, 25th and February 1st, 1929) by Beaver discounts the usually accepted dilation theory.

* See Elec. Rev., November 13th, 1925, p. 774.

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It should be clear that the desirability of employing super-voltage cables for this system devolved pre-eminently on the insulating qualities of the cable for the peculiar conditions of service.

Though it is not universally accepted that functions of the dielectric losses are a criterion of the excellence of the cable or an indication of the permanence of electrical and physical stability, we are definitely of opinion that, had we not made use of the three valuable characteristics briefly described above in our specification, we should not have been in a position confidently to adjudicate on the merits and demerits of the excellent tenders received: the decision was in favour of a three-core belted cable.

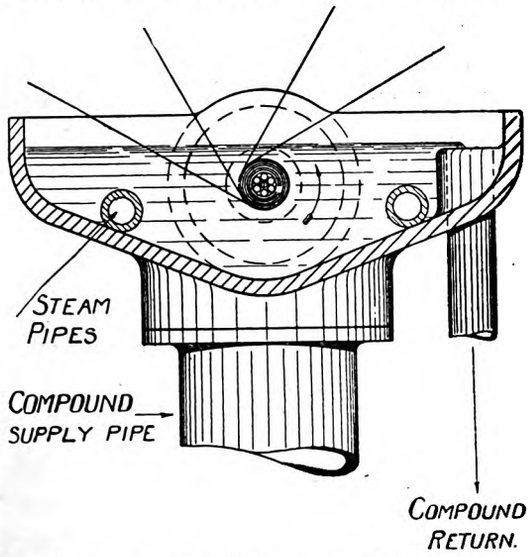

Fig. 2.—Assembly of Cable under Compound.

The specification called for a large percentage of the cable lengths to be tested as in (*a*) over a range of voltage from 13 to 26 kV; the power factor at the higher limit was specified not to exceed 2 per cent., and its increase over the whole range not to exceed 0.5 per cent. The successful tenderer increased the stringency of this test by guaranteeing the latter figure at 0.2 per cent.

The characteristics under (*b*) were specified not to exceed 2 per cent. over the whole range of temperature up to the working temperature (of 120 deg. F.).

The final of these power factor tests (*c*) was specified to be carried out after cooling as in (*a*) on all lengths previously heated for test (*b*) and compared with the results of the first power factor/voltage test (*a*).

The difference in power factor had not to exceed 2 per cent.

The stringency of this test was increased at the suggestion of the successful tenderers by maintaining the temperature of test (*b*) at 120 deg. F. for two hours.

These tests were carried out on 40 per cent. of the cable lengths, and came well within the guarantees.

As the time factor enters largely into the question of break-down under pressure, the modern trend of opinion is against raising the test pressure inordinately, and though the specification called for an excess pressure test of 40 kV on all lengths for one hour, the manufacturers put forward the alternative of 60 kV for 15 minutes, which was accepted and successfully applied.

It was also specified that a break-down pressure test should be applied to the sample used for the bending test (the latter to be carried out in accordance with the B.E.S.A. Specification No. 7 of 1926), and that the sample should withstand 80 kV for 15 minutes, after which the pressure was to be raised to the destructive point and the rupturing voltage submitted.

The manufacturers elected to increase the stringency of this by subjecting a sample to this test from one of the lengths previously heated for the power factor/temperature test, and at the same time guaranteed a sample previously heated as above, but not subjected to the bending test, to withstand a pressure of 100 kV for 15 minutes. These two tests were successfully carried out, the break-down pressures being 128 and 149 kV, respectively.

The collaboration of cable manufacturers was solicited in the specification to offer suggestions. Messrs. Glover & Co. made the following recommendation, which was accordingly embodied in the order:—

> "A sample of cable, two yards in length and in its lead-covered state, shall be subjected to the following tests for bleeding:—
>
> "The length shall be suspended vertically and then heated by means of a current of 200 amperes (a.c.) passed through each of the conductors while the lead sheathing is maintained at a temperature of 100 deg. F., either by means of suitable lagging or by enclosure in a heated vessel. . . .
>
> "The total amount of compound which shall bleed from the cable when it has been continuously maintained under the above conditions for seven days shall be less than three grammes."

The amount of bleeding was reported by the inspecting engineers to be negligible. (It is to be noted that the amount of bleeding in a similar cable supplied for a local mine by the same firm and tested similarly was absolutely nil.)

Also, at the instigation of the manufacturers, all cables in their lead-covered state were subjected to a hydraulic pressure test of 60 pounds per sq. in. by being completely immersed in a hydraulic pressure tank.

Cable manufacturers were required to guarantee the continuous and successful operation of the system for a period of five years from the date of satisfactory pressure test *in situ*.

Mr. C. J. Beaver gives the following information on his prior-impregnation method:—

The primary difference between the Glover method of making impregnated paper cables and the common vacuum *en masse* method is, and has always been, that in the Glover process the paper is impregnated in sheet form prior to its application to the conductors instead of *en masse* as in the post impregnating process. This not only ensures that every part of the dielectric has exactly the same treatment, but also gives the advantage, which is fundamentally important for the purpose under review, that the impregnation process is unfettered by any viscosity limits of the impregnating medium. The single sheet of paper passing through the impregnating machine receives a preliminary drying, and then passes through molten compound at a definite rate, *i.e.*, providing a definite time of exposure to the air and moisture expelling action of the hot compound.

Following the production of the perfectly impregnated dielectric material, it remains to assemble it in the necessary laminated form upon and around the conductors in such a manner that no ionisable matter is occluded in the ultimate mass. Assuming that air and gases are excluded from the material as a result of the method of preparation above referred to, the proposition that occlusion of air is preventable by assembly out of contact with air (*e.g.*, under hot compound) leaves little scope for argument.

In assembly the cable rotates on its own axis at a suitable rate while travelling laterally through the trough of compound, causing the strips of previously impregnated paper to be accurately wound upon it. It will be seen from fig. 2 that the strips pass through an appreciable depth of compound before reaching the cable, and that the whole area of assembly is completely excluded from air, so that the only matter which can be entrained in the lappings is a thin film of the compound, the thickness of which is dependent on the viscosity of the compound at the trough temperature and the tension applied to the paper strips; and, as these conditions are closely constant, the film is correspondingly uniform throughout both the length and the radial thickness of the insulation. The actual thickness of the film is of capillary order, but is sufficient to allow the necessary amount of movement of the papers over one another when the cable is bent.

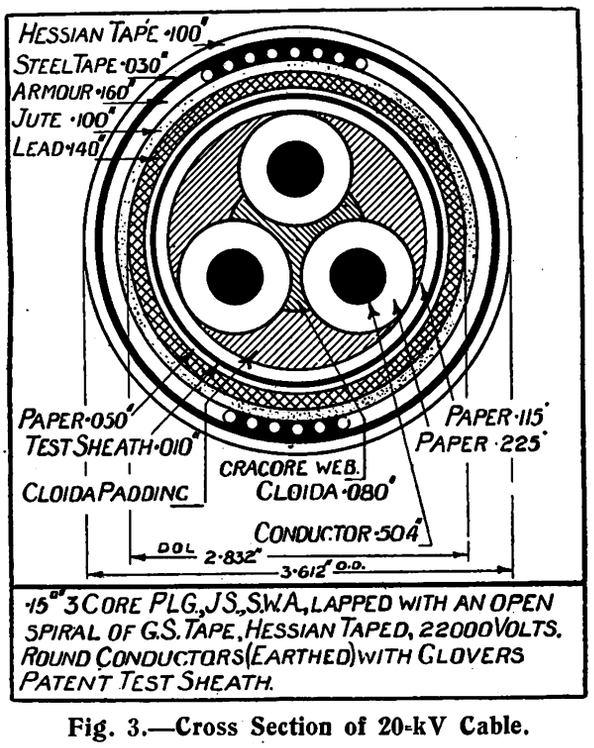

Fig. 3.—Cross Section of 20-kV Cable.

The physical conditions in the dielectric proper resulting from the above described impregnating and assembly processes are as follows:—

(1) In every part of the paper itself there is an uniform filling of compound which is solid at normal temperatures and highly viscous at the maximum working temperature of the cable.

(2) All interstitial spaces in the dielectric, *i.e.*, between the layers of impregnated paper, and between the edges of their convolutions, are filled and sealed by the entrained compound, which, being in the form of thin films, is to a large extent held in place by capillary forces, apart from the viscosity of the material.

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As the result of these conditions, it is ensured that:—

(*a*) The electrical stability of the dielectric under high values of electric stress is a maximum, because of the elimination of ionisable matter.

(*b*) Under an infinity of heating and cooling cycles, representing working conditions, physical stability is maintained, *i.e.*, no bleeding or draining of free compound can occur.

It is not, I think, well appreciated that such bleeding as occurs in a cable under the drainage test is almost entirely *via* the interstices of the stranded conductors and the padding spaces.

The ordinary paper string or compressed paper strips used to fill these spaces constitute a series of laterial tubes or channels, which, compared with the laminated dielectric, may also be regarded as fairly free paths, especially when the cable is vertical.

In our cable, these drawbacks are entirely obviated by filling the strand interstices with a plastic compound which cannot by liquefied by heat, and therefore cannot flow from its original position. It is applied over each layer of wires during the stranding operations, and the succeeding layer strongly compresses it into the underlying layer, and also receives the surplus exuding outwards.

The assembly of cores and padding strips is performed under hot compound, and from the point of convergence of the component parts, the cable passes on to receive its overall lappings under the same air-excluding conditions as the core insulation.

Finally, the lead sheath is also applied under air-free conditions. That is to say, there is a supply of compound fed to the cable, and the clearance annulus is filled; whereas, in the ordinary process, the tendency is for the impregnating compound to be drained out of the insulation by the heat of the lead press box, and the annulus to contain an appreciable amount of air and gas.

Surveying the cross section of the cable (fig. 3) up to the lead sheathed stage, we have:—

(*a*) Conductors with interstitial spaces filled with non-meltable compound.

(*b*) Core dielectrics free from ionisable gases and having all spaces between laminæ, &c., filled with films of compound, the conditions as a whole being such that physical (and, consequently, electrical) stability is ensured under all working conditions of the cable.

(*c*) Non-fibrous, resilient fillings which can neither themselves move in relation to, nor permit gradual drainage from adjacent paper surfaces.

(*d*) Overall or belt insulation having the same properties and characteristics as the core dielectrics (*b*).

(*c*) The clearance space between the outer surface of the dielectric and the inner surface of the lead sheath completely filled with a film of viscous compound.

Each cable is made up of eleven individual lengths, the longest of which are in the vertical in No. 14 shaft, and consist of two lengths (for each cable system) of 1,150 ft. each.

During jointing operations, which occupied from 10 to 12 hours per joint, temperature and relative humidity figures were taken. The maximum figures obtained were at the first shaft pocket in No. 14a shaft, *viz.*, 110 deg. F. and 89 per cent. The average values for these figures were 80 deg. F. and 82 per cent. relative humidity.

When the joint is completed, prior to pouring, the joint box lid is bolted on and the desiccator is applied. The desiccator consists of a petrol-engine driven air pump, which pumps air at a few pounds above atmospheric pressure through a series of four vessels containing a calcium-chloride drier in trays, thence by a hose and connection to the sealed joint box, whence it exhausts to atmosphere by a pet cock screwed into the box for the purpose. The period for desiccating was varied from half to one hour, according to the humidity.

As most of the joint boxes contain over 200 pounds of compound, and bearing in mind the extreme importance of avoiding, as far as possible, the occlusion of gases in the compound during filling operations, this boiler is equipped with a hand pump for circulating the compound during the heating period, and later, by the manipulation of valves, for the filling process, the compound being piped to the boxes. The compound is heated by a paraffin burner to about 10 deg. F. higher than the pouring temperature of 320 deg. F.; the break-down voltage of the compound is 55 kV for the B.E.S.A. oil-testing gap, *i.e.*, 150 mils between ½-in. spheres.

For the inbye joints it was necessary to retain the boiler in the cage and pipe the compound through piping as long as 24 ft. to the boxes, in which case it was necessary to heat the pipes with blow lamps before pouring.

After the joint boxes had been sealed up and allowed to cool off for a period not less than seven days, they were opened up and topped; the shrinkage was found to vary between 1¾ in. to 3 in. In spite of these elaborate precautions, air holes showed up in one or two cases; these were carefully heated with blow lamps and melted compound allowed to fill in, after which they were topped.

The installation was carried out under the supervision of Mr. Winstanley, the contractor's cable engineer; the jointing was also done under the supervision of this gentleman by the contractor's jointer; it was one of the conditions of the contract that the mine cable jointers should be initiated into all the phases of super-voltage jointing.

Reviews.

Stores Accounts and Stores Control. By J. H. Burton, A.S.A.A. Pp. ix+144; forms and rulings. London: Sir Isaac Pitman & Sons, Ltd. Price 5s. net.

Industrial Storekeeping, Accounting and Perpetual Inventory. By C. Hanneford-Smith, F.C.W.A.; foreword by Sir John Corcoran, K.B.E., C.B. Pp. x+114, illustrated. London: Gee & Co. (Publishers), Ltd. Price 8s. net.

Who can disagree with Mr. Burton, when, in his preface, he writes "From a theoretical point of view the keeping of Stores Accounts is so simple . . ." or fail to agree that in practice the simplicity vanishes?

Those opening words of wisdom must be the basis of test of the value of these two books.

Again, in the same preface, the author gives prominence to the need for a substantial return in the way of reduction of expenses from what may be the heavy expense of installing and maintaining the correct system for any business.

This is the criterion of success for the organiser, whether it be in the organisation of stores control, or of any other system introduced into an industrial or commercial establishment.

Let us then see in how far these two books attain the standards set; whether they give advice or guidance of a practical nature, and whether there is any indication of the economies that should obtain when their suggested methods are adopted.

To do so we must first summarise the field surveyed by each of them; perchance the fact that they are both reviewed at the one sitting may be of help to those in search of assistance in this important sphere.

Mr. Burton, after dealing with the theory and practice of stores accounting, goes on to the consideration, first, of all of personnel, and, secondly, of the stores itself. The former, as in all matters of organisation, is the first essential factor—getting hold of the right man for the job and then using his abilities to best advantage.

"Where should the stores ledger be kept?" is a question that needs to be answered, for it is of greater importance than may, at first glance, appear. Mr. Burton rightly says that it depends on the circumstances, and then gives some sound advice. There follow some practical problems in Chapter V; problems relating to the checking of weights, empties and packages, the treatment of carriage and overhead charges, that very vexed question of pricing out, wastage and shortage, and amongst many others, the setting of maximum and minimum stock, and of ordering levels, upon which subject the author in common with every other author so far, gives merely a few fragmentary notes. The point is mentioned in at least three places in the book, and we are told there are many factors to consider. We know it too well, but what we and every student want to know is exactly how you do it in particular cases. Tell us all about the conditions and what you did in order to fix your limits, and we will thank you more for that, than for many pages for generalisation. The fact is people are frightened about it. So much depends upon the correct setting of limits as to whether you have, on the one hand, too much capital locked up in your stores, and, on the other, whether you have the goods there when they are required. This book would be twice the value if it only showed us how to do it.

Chapter VI deals with the relation between the stores and the other administrative departments, and includes a useful summary of the advantages and disadvantages of central purchasing and stores stocktaking, the stores accounting system and the forms necessary to work it, of which there are over twenty illustrated; auditing and the use of office machinery occupy the following chapters. In the machinery chapter a fairly comprehensive survey is made of modern appliances, without some or all of which stores control cannot be performed with both speed and precision. The Hollerith and powers systems are described as completely as need be in a text book. The Burroughs, Sundstrand, Elliot-Fisher, and Remington machine ledger posting systems are given less space than they deserve, and we scarcely think that sufficient prominence is given to the Kardex and similar stores ledgers, in which signalling the state of the stock is such a valuable feature. The Paramount and D.P. methods are commented upon. We are pleased to see that nearly one-third of the book is devoted to these modern appliances, but regret very much that the author has left so much to description, whereas a photograph showing details of the appliance is much more interesting and easy to follow. Will he be so good as to include them in the second edition into which we hope the book will eventually pass? From our experience, however, we are quite sure that the makers of the machines will be only too glad to supply the inquirer with what their sales staff so persistently refer to as "literature." But, oh student, if you do get hold of any of this so-called "literature," use heaps of salt to get the right flavour into the makers' accounts of the marvellous feats the machines will perform—apparently, almost without human aid!

The final chapter is allowed only four pages. Its subject is "Stores Control." In a way it is a summary of control methods advocated in previous chapters, but as a chapter on stores control it is woefully inadequate and a severe anti-climax to a book that, as a description of methods of accounting and of the way to overcome practical difficulties, has much to commend it.

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In fact that second edition, with a few such amendments as we have presumed to suggest, should be a leading authority on the whole subject. Two pleasant features are the price, and the author's clear style of writing. The appearance of being a collection of papers which the author has written, perchance for the learned societies of which he is a distinguished member, does not really mar the continuity of the narrative.

In a way Mr. Hanneford-Smith has followed the general plan adopted by Mr. Burton, but his book requires a little more unravelling. There is no list of sub-headings of chapters, nor are the sub-headings themselves clearly set out. On the other hand, he gives a list of forms, accounts, &c., which is most valuable for reference. There are twenty-three forms and ten photographs of appliances, &c.

One of his good points is that he illustrates some of the forms with figures, which make their use so much more readily grasped. And, again, the illustrations of Kardex and other visible record index appliances are very clear and of help in giving some idea of their use.

Chapter VI is headed "Modern Methods of Recording Stocks" and takes up twenty-two pages. In it are described the Bizada, Costmeter, Kardex, and Roneodex visible record systems. He might just as well have described one of them, perhaps at greater length. The inclusion of four, all on similar lines, to the exclusion of the Hollerith, Remington, and other machines is a fault which cannot be overlooked. The omission very considerably reduces the value of the whole book. In certain circumstances a hand-written visible index may be the best method, we agree, but in others the use of machinery is certainly necessary if economical storekeeping records are to be maintained, and in very large concerns the Hollerith and Powers machines may be the most efficient and economical. At any rate, the inquirer should be told that such machines are available.

The author might well have made his title "Some Notes on Certain Problems in Stores Accounting and Control," and then the prospective reader would have been warned to look first to see if the particular problem upon which he wanted some advice or experience was mentioned. But, with such a title, the price of the book would no doubt have had to be lower.

What is needed in a general text book (and the titles of these two books lead one to suppose that that was their authors' purpose) is a well-written continuous narrative, fully indexed and sub-headed, treating all sides of the subject, and, in the absence of lengthy description, reference to where such treatises may be found; an ample sprinkling of practical cases, and, where figures are concerned, plenty of them to make their meaning clear; illustrations of any appliances or machinery cited; and, most important of all, a statement of the theoretical aspect of each point, with a *résumé* of practical difficulties encountered in employing the theory, together with examples of exactly how the difficulties have been overcome. If a committee were appointed to draft the general conditions governing the writing of text books, they would include these and several others. Perhaps they would want to examine the would-be authors too, and that might not be a bad step to take. Then, provided the author had the experience worth writing about and would fulfil the conditions, the student or engineer would at last be sure of knowing how to find what he required, and would take some little pleasure in doing so. Is it too much to hope for such a state of affairs? Really, the modern advances in methods of organisation should spread to the writing of text books. If that happens, the reviewer's lot will be a happier one!

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

The E.T.B.I. Competition.

The Secretary of the Electrical Trades Benevolent Institution (Capt. J. T. Keeping, M.C.) has sent us the solution to the problems set in the Institution's competition. It will perhaps be remembered that the names of 16 towns were given in a cryptic manner and that the problem was to identify the towns and give the shortest length of cable necessary to connect all the towns together, starting and ending at the G.P.O., London.

The towns were:—Coventry, Perth, Nottingham, Yarmouth, Portsmouth, Sheffield, Luton, Liverpool, Brighton, Manchester, Oxford, Exeter, Bath, Doncaster, Cambridge, and King's Lynn. The length of cable required was 1,496.5 miles. All competitors who correctly "spotted" the towns are asked to send in a claim on a postcard, to the Secretary at 9, Southampton Street, Holborn, W.C.1, stating the mileage of cable entered in their solutions.

Dutch Electrical Imports and Exports.

The following table shows the value of Dutch imports and exports of electrical machinery and apparatus during the past two years:—

	Imports.		Exports.	
	1928	1927	1928	1927
	£	£	£	£
Electrical machinery ...	735,300	608,100	599,350	447,750
Radio apparatus ...	797,300	406,550	1,924,800	776,250
Telegraph and telephone material	703,050	470,850	47,200	64,000
Insulated wires & cables	660,900	835,750	346,550	290,150
Dust collectors, electric	268,500	208,950	25,050	14,800
Filament lamps ...	73,850	84,750	2,011,500	1,641,650
Electric tramcars ...	30,600	58,300	1,750	25,500
Electric locomotives ...	8,250	13,750	56,250	—
Arc lamps	2,850	2,300	12,050	12,400
Other electrical material	697,150	608,450	267,150	235,650
Totals ...	£3,977,750	£3,297,750	£5,291,650	£3,508,150

It will be seen that radio material represents 20 per cent. of the imports, electrical machinery following with 18.5 per cent., telegraph and telephone material 17.7 per cent., and insulated wires and cables 16.7 per cent. Germany is credited with 58½ per cent. of the imports, Great Britain being second in the list with 9.5 per cent. An analysis of the exports shows that metal-filament lamps represent 38 per cent. of the total, radio apparatus 36.4 per cent., electrical machinery 11.3 per cent., and insulated wires and cables 6.6 per cent. France is the largest customer for Dutch electric lamps. France, Germany and England are the chief buyers of Dutch radio apparatus, while Germany takes 28.8 per cent. of the Dutch exports of electrical machinery.

Plumber-Jointers' Wages.

Consequent upon the alteration of wages in the electrical contracting industry (*vide* our last issue, p. 563), the wages of plumber-jointers and plumber-jointers' mates in the Greater London area will be at the rate of 1s. 10½d. and 1s. 5.8d. per hour, respectively, as from the second pay-day in October up to and including the period covered by the last pay-day in this month.

New Italian Companies.

Among the new companies recently formed in Italy are the Società Azienda Elettrica Asolana, organised at Ascoli Piceno with a capital of 2,000,000 lire; La Società Impresa Elettrica di Illuminazione di Roccastrada, 500,000 lire; La Società Accumulatori Leggeri Pouchain, 550,000 lire; La Società Ligure Prodotti Elettro-Siderurgici Alpe, 50,000 lire; and La Società Industrie Elettro-techniche Nazionali, 120,000 lire.

Unemployment.

An increase of 15,380 in the number of unemployed is shown for the week ended September 23rd. At that date the total was 1,162,900, as compared with 1,147,519 on September 16th, and 1,295,234 on September 24th, 1928.

Works Visit.

About 90 members of the Ipswich Engineering Society visited the Osram Lamp Works of the General Electric Co., Ltd., at Hammersmith, on October 2nd. The party was accompanied by Mr. C. J. Robinson, secretary of the society, and Mr. F. Crush, manager of the Ipswich branch of the G.E.C. On arrival at the works the party was split up into small groups and placed under the charge of special guides. They were then conducted over various sections of the works, the guides demonstrating and explaining the different methods

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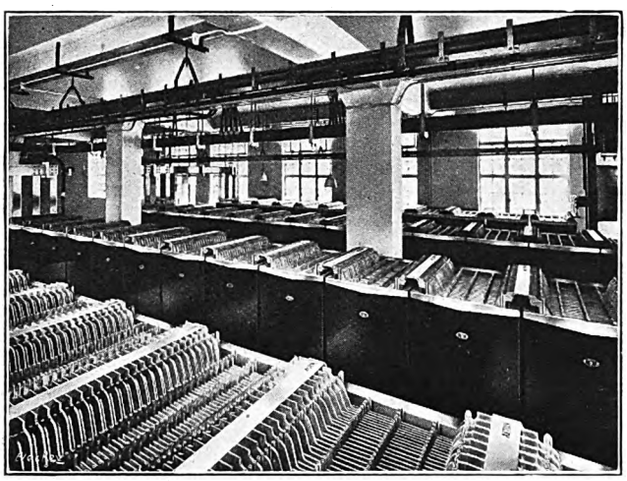
of manufacturing "Osram" electric lamps and radio valves. Subsequently the Osram glass works and the G.E.C. laboratories were visited.

"Alton" Telephone Batteries.

The "National" automatic telephone exchange, one of the new 10,000-line London exchanges recently put into commission, is equipped with two "Alton" batteries (illustrated herewith), each of which has a capacity exceeding 10,200 Ah at the 10-hour rate of discharge. Both of the batteries are made up of 47-plate cells each weighing nearly 3 tons. The plates measure 20 in. by 30 in., each positive and negative weighing about 70 lb. and 45 lb., respectively. The load on modern automatic exchanges exceeds the current taken by many small towns for lighting and power purposes, and the Alton batteries



"Alton" Batteries at the "National" Telephone Exchange.

at "National" are capable of giving an output in excess of 5,000 A for one hour. The size of these batteries, which are probably the largest on telephone service in Great Britain, can be judged from the dimensions of the cells, which are nearly 4 ft. in length and height and 2 ft. 6 in. wide.

Electric Trolley 'Buses for Brazil.

The Commercial Secretary at Rio de Janeiro (Mr. S. G. Irving) reports that a syndicate in Brazil, having in view the establishment of a service of electric trolley 'buses over a distance of 150 kilometres, desires to receive literature from British manufacturers. Details of the inquiry can be obtained by interested British manufacturers upon application to the Department of Overseas Trade, 35, Old Queen Street, S.W.1. (Reference A.X. 8616.)

Radio and the Music Trades.

A conference to discuss the relationship between the radio and music trades was held in London on October 3rd. Mr. A. E. Ball, president of the Gramophone Dealers' Association, took the chair, and in some introductory remarks said that those present were all very concerned at the serious price-cutting which was prevalent in the radio industry. Mr. J. T. Mould, chairman of the Radio Manufacturers' Association, said that price-cutting was due to the fact that the business had got into wrong hands. All kinds of undesirable people had entered the trade because there was money in it. Now, when competition was so keen, there was not so much money, and they resorted to price-cutting to attract customers. The subject had been discussed by the responsible associations of the industry, and certain plans were being formulated which he hoped would lead to better conditions. Mr. Mould then proceeded to deal with the principal subject of the conference. He said that the radio trade and the retail gramophone trade were complementary. People wanted both forms of entertainment, and it was inevitable that the radio receiver and the gramophone would be combined. Dealers in each trade would meet with handicaps when taking up the other business. The radio business required technical knowledge and "service," which could only be obtained by the employment of skilled electricians.

A discussion took place upon Mr. Mould's address. One of the main points which arose was the variation of discounts in the radio industry. Strong representations were made that there should be a standard discount throughout the trade. One speaker said that there was nowadays no difficulty in obtaining skilled men to look after radio sets, but he said that they should aim at bringing out a combined instrument which was as simple and "foolproof" as the ordinary gramophone.

British Malayan Electrical Imports.

The imports of electrical machinery and apparatus into British Malaya during last year reached a value of £1,181,150, as compared with £876,000 in 1927. Great Britain is credited with 79 per cent. of the imports, as against 10.7 per cent. to the United States.

The Marking of Imported Vacuum Cleaners.

The *Board of Trade Journal* announces that the application made for the marking of imported electric vacuum cleaners, under the Merchandise Marks Act, 1926, is not being proceeded with.

Revenue from Electrical Advertising.

An increase in annual gross revenue of $200,000,000 was recently held out as an inducement to American electric light companies to promote electrical advertising service on a broad scale. Mr. C. R. Tracy, addressing the annual convention of the Illuminating Engineering Society, which was held at Philadelphia, gave the foregoing amount as a conservative estimate of the added revenue which the companies might derive from the sale of energy to operate "electrified salesmen." Mr. Tracy said that electrical advertising should be promoted by the companies as a load-building operation. Many companies had failed to recognise the value of this type of load. As a general rule, energy sold for electrical advertising constituted a long-hour, high-rate load, going on existing lines and one which required the minimum of additional meter and transformer equipment. The speaker emphasised the importance of proper sign maintenance, which included the replacement of burned-out lamps, painting and varnishing signs, weekly inspection, winding and setting clocks, and display changes. The cost of maintenance was more than offset by the added revenue received as a result of the added care.

Polish Electrical Imports.

According to a recent report, the value of the electrical machinery and apparatus imported into Poland during last year amounted to £2,883,850, as compared with £2,164,550 in 1927. The trade is largely in German hands, that country being credited with 55 per cent. of the imports, the remainder being divided, in the following order, between Sweden, Austria, Holland, Switzerland, France, Czecho-Slovakia, Hungary, Belgium, and Great Britain, the British share, however, being only 1.1 per cent.

Nicaraguan Electrical Imports.

During 1928 the Republic of Nicaragua imported electrical machinery valued at 119,940 cordobas (about £24,000), practically all of which came from the United States and Germany.

Lancashire-Crypto Extensions at Willesden.

The Crypto Electrical Co., which recently acquired the business of the Langham Gears of Slough, has now completed the equipment of a new factory adjoining its present works in Acton Lane, Willesden, N.W. This extension, built expressly for the purpose of manufacturing the Langham gears, will enable the increasing demand for these geared motor units to be met. The motors will pass direct from the company's existing works to the new factory for assembly with the gear units.

Book Notices.

"Electrical Wiring and Contracting." Part I. Edited by H. Marryat, M.I.E.E.—This comprehensive work is to be published in about 30 weekly parts, commencing October 12th; price 1s. each part Included in the list of subjects to be discussed are:—"Workshop Science," "Alternating Current Work," "Mathematics," "Measuring Instruments and Testing," "Primary and Secondary Batteries," "Motor Starters and Regulators," and "Converting Plant."

"Electric Arc Welding Operators' Handbook." Pp. 38. London: Alloy Welding Processes, Ltd.—This booklet is intended for the progressive operator who wishes to keep up-to-date with the latest developments in metallic arc welding. The first section is devoted to instructions for beginners, and is followed by a description of the A.W.P. process outlining its advantages. Conditions of electrical supply plant, &c., for welding are also dealt with and types of A.W.P. electrodes for the various classes of work are included. The booklet is concluded with diagrams showing the preparation of joints and some excellent illustrated examples of welded work.

"Science Abstracts" (A. & B.), Vol. XXXII. Part 9. September 25th, 1929. London: E. & F. N. Spon, Ltd. Price 3s.

"Overhead Power Lines," by W. Morecombe. Pp. xi+236; illustrated. London: Chapman & Hall, Ltd. Price 15s. net.

"The Book of Electrical Wonders," by E. Hawks. Pp. 316; illustrated. London: G. C. Harrap & Co., Ltd. Price 7s. 6d. net.

New Spanish Company.

It is reported from Madrid that under the auspices of several French concerns, including the Société Générale de Constructions Electriques et Mécaniques "Alsthom," the International General Electric Co., and the Sociedad Iberica de Construcciones Electricas, negotiations are in progress relative to the formation of a new company to establish large electrical engineering works in Spain.

German Electrical Imports and Exports.

A return just issued shows that the imports of electrical machinery, cables and electrical fittings and accessories into Germany during the seven months ended with July last. attained a value of £1,525,100, as compared with £1,255,850 in the corresponding seven months of 1928. The exports of similar material from Germany during the same periods advanced from £13,289,200 to £15,817,600.

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United States Electrical Exports.

During July last the value of electrical machinery and equipment exported from the United States was $12,891,948 (against $9,919,988 in July, 1928), bringing up the total for the first seven months of the year to $83,669,418 ($63,186,854). Among the most important increases were the following:—Radio apparatus, from $948,431 to $1,787,342; refrigeration sets up to 1-ton capacity, from $575,748 to $1,186,566; telephone apparatus, from $247,882 to $615,184; insulated copper wire and cable, from $394,373 to $504,612; stationary motors (1 to 200 h.p.), from $198,532 to $449,585; transformers (500 kVA and over), from $124,051 to $226,898; motors ½ h.p. and under, from $193,572 to $246,238; and railway signalling apparatus, from $65,904 to $170,077. There were few important decreases, the largest occurring in the case of switchboard panels (not telephone), from $258,509 to $64,485.

As usual, Canada was the United States' principal customer, taking goods valued at $3,876,794. The United Kingdom took second place with $1,002,814, and Brazil, with $903,446, was third. Other large importers of American electrical goods were Argentina ($864,472), Australia ($676,404) and Mexico ($494,183).

German Aluminium Import Duty.

The United Aluminium Works, Co., which is owned by the German Reich, has applied for the imposition of an import duty on crude aluminium, the proposal having so far been received favourably. It is considered that a Bill will be introduced for the purpose now that the consuming industries have expressed themselves in favour of the scheme, with the reservation that the amount of the duty should only be sufficient to avert the possible dumping of American material upon the German market, and not great enough to cause an increase in the price in the home market.

Large American Radio Merger.

It is reported from New York that three large radio manufacturing concerns—the Kolster, Earl and Freed-Eisemann companies—have merged their assets, valued at about $50,000,000. The Earl company already held a controlling interest in the Freed-Eisemann concern and three of its shares will be exchanged for one Kolster share. The group is said to control over 700 radio patents.

Tube Works Closed Down.

As the result of a failure of negotiations between the British Mannesmann Tube Co. and its employés on the question of a reduction in wages, the company's Landore works, near Swansea, were closed down last week.

New French Companies.

Among the new companies recently formed in France are the Société d'Etudes pour l'Amenagement des Chutes du Rhone de Valence à Mondragon, with a capital of 600,000 fr., to prepare plans for the establishment of a hydro-electric station on the River Rhone between Valence and Mondragon; and La Société Alsacienne de Véhicules Electriques, with a capital of 2,500,000 fr., to manufacture, sell and maintain electric vehicles in Alsace.

The Transfer of the Shanghai Undertaking.

Some particulars of the transfer of the Shanghai electricity undertaking from the Municipality to the Shanghai Power Co. have been sent us by Mr. T. H. U. Aldridge, who remains chief of the undertaking, with the title of vice-president and general manager. The other principal officers are:—Mr. C. S. Taylor, deputy general manager; Mr. H. Gordon Wright, secretary; and Mr. E. J. Edgar, chief engineer. As from August 9th the company assumed all the current operating and employment contracts and contracts entered into by the Council for the purchase of plant for the account of the Electricity Department, and all other obligations. The company was also authorised to collect all outstanding accounts rendered in the name of the department. The office is still at 17, Foochow Road (P.O. Box 404), Shanghai, but communications should now be addressed to the Shanghai Power Company.

Italian Lamp Production.

The output of electric lamps in Italy during April last amounted to 1,369,976, bringing up the total for the first four months of 1929 to 6,834,235 lamps, as compared with 5,491,030 in the corresponding period last year.

Social Events.

A swimming gala under the auspices of the Magnet Social Club (General Electric Co., Ltd.) was held recently at the Holborn Baths. A number of events were decided, and remarkably close finishes and times were the rule. The two main events were competitions between various G.E.C. London establishments for cups presented for team events by Mr. and Mrs. L. C. Gamage. Mrs. Gamage's cup was won by the G.E.C. Research Laboratories, who beat Magnet House, and the L. C. Gamage cup was won by Fraser and Chalmers, Erith.

The Sunco Swimming Club held its first annual gala at the Holborn Baths on September 30th, when several interesting events were contested. Principal among these were the finals for cups presented by Mr. A. G. Beaver and Mr. R. Tweedy-Smith, the former being for men and the latter for ladies. The cups were won by Miss Glover and Mr. S. Davidson. The G.E.C. team was successful in the men's team race. The prizes were presented by Mrs. R. Tweedy-Smith.

The annual bowling match of the Electrical Contractors' Association of Scotland (East *v.* West) was held on September 25th, on the bowling green attached to the Hall of the Royal Company of Archers, Edinburgh. The weather was good, and the match proved to be most enjoyable. Three rinks were played, and, as usual, the West were victorious, winning the match by two rinks to one. After the match the visitors were entertained to tea in the archery butts of the Royal Company by the Edinburgh members. By the courtesy of the Royal Company, the visitors were shown over the Hall and premises of what is known as "The King's Bodyguard," and very much appreciated the wonderful trophies and fine collection of pictures.

Criticism of the Patent Law.

In an address to the Bristol section of the Society of Chemical Industry last week, Dr. Herbert Levinstein (British Dyestuffs Corporation, Ltd.) severely criticised the existing patent laws of this country. He maintained that a very large proportion of the patents granted were applied for merely to block the development of useful inventions. If contested, most of them would be adjudged invalid, but the cost of patent litigation was so great that there was considerable hesitation in commencing an action. He said that the Association of British Chemical Manufacturers was preparing a memorandum on the subject to place before the Board of Trade Committee recently appointed to consider and report upon the existing patent law.

Glareless Lamps.

In pursuance of its campaign to inculcate in the public a preference for "pearl" and "opal" lamps over clear-glass lamps, the Electric Lamp Manufacturers' Association demonstrated the virtues of glareless lamps to a party of visitors at the London Lighting Service Bureau on October 3rd. The visitors were welcomed by Mr. W. F. Moir and Mr. W. J. Jones, and Mr. W. Barker, a past president of the British Optical Association, addressed them upon the evils of glaring illumination, particularly in industry. Mr. L. E. Buckell mentioned that glareless lamps had now been adopted by a number of the leading transport organisations, theatres, &c.

A similar meeting was held at the Grand Hotel, Birmingham, on the following day. Mr. W. J. Jones addressed the company and demonstrated the virtues of the glareless lamps, and Mr. E. J. Jennings, secretary of the Birmingham Electric Supply Department, presided at a subsequent luncheon.

The 20th Illumination Design Course.

We have received from the Electric Lamp Manufacturers' Association the programme of the 20th Illumination Design Course, which is to be held at the London Lighting Service Bureau on seven successive Monday evenings, commencing on October 21st. The subjects of the lectures will be as follows:—"The Lamp of To-Day" (Mr. L. E. Buckell); "Illumination Design" (Mr. F. Marsh); "Selling Electric Light to the Shopkeeper" (Mr. T. Catten); "Electric Lighting in Industry" (Mr. S. Anderson); "Electrical Advertising" (Mr. H. Lingard); "Architectural Lighting" (Mr. R. W. Maitland); and "Miscellaneous Lighting Problems" (Mr. W. J. Jones).

An Electric Wash-house at Wallasey.

The Manchester *Daily Dispatch* reports that Wallasey is to have one of the most up-to-date municipal wash-houses in the country with electric washers, electric drying houses, and an electric mangle. The Corporation Health Committee has decided to apply to the Government for sanction to borrow £16,500 for this purpose, and it is hoped to complete the new building in about five months. Eighteen slipper baths are included in the scheme.

New Turkish Import Duties.

A new scale of import duties on electric motors, dynamos, transformers, commutators, resistances, coils, magnetos, sparking plugs, convertors, distributors, &c., came into operation in Turkey on October 1st. Hitherto these have been dutiable at rates ranging from £19 to £37½ Turkish paper (£T1 = approximately 2s.) per 100 kg. (2 cwt.). In future such goods are to be divided into the following six classes: Up to 10 kg., £T40; 10 to 50 kg., £T12.50; 50 to 100 kg., £T7.50; 1,000 to 2,000 kg., £T6.50; 2,000 to 5,000 kg., £T5; and over 5,000 kg., £T4., the rates being all per 100 kg.

The New Zealand Radio Market.

The United States Consul at Wellington reports that in New Zealand the American electrically-operated radio receiver is rapidly displacing the battery-powered instrument, and the local market is in a decidedly unsettled state. Battery sets, of which large stocks are still held, are being marketed at practically cost, or even below cost, prices. The United States is the exclusive supplier of this new type of instrument; there are at least six makes retailing at from $170 to $1,215 for the "de luxe" cabinet models. Discounts of from 25 to 30 per cent. are the rule, from wholesaling importer to retailer, while American suppliers' prices are anywhere from 20 to 40 per cent. below landed costs. Electric sets are utilisable in practically all parts of New Zealand. The 230 voltage is universal. Some dis-

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satisfaction is being expressed by local dealers over the failure of most American suppliers to furnish sets capable of direct operation on a.c. at 230 volts. In many cases a transformer must be used outside of the set proper which, while only slightly increasing its cost, results in a certain amount of inconvenience. It is thought that "salability" would be enhanced if the American manufacturer would arrange to incorporate the transformer in the body of the instrument, or supply an export model designed to work directly on 230 V.

Trade Announcements.

Messrs. Belling & Co., have appointed Messrs. Nutter, Son, & Edge, Ltd., Cromford Court, Manchester, as principal agents for the sale of their electric fires and cookers in the Lancashire, Cheshire and North Wales area. A large stock will be available.

The Cardiff branch of the Tungsram Electric Lamp Works (Great Britain), Ltd., has been removed to larger premises at 16 and 17, Hills Terrace. The telephone number is unaltered.

Bankruptcy Proceedings.

S. B. Watson, trading as S. B. Watson & Co., 73, Crouch Street, Colchester, electrical engineer and contractor.—The public examination herein was held on October 3rd at Colchester. According to the statement of affairs, there were liabilities amounting to £2,757, and a deficiency of £2,378. Debtor stated that he commenced business in February, 1927, without capital, but he had a bank overdraft of £200 guaranteed by his father. Structural alterations were carried out to his father's premises costing between £300 and £400. Debtor stated that for the year ended September, 1928, the turnover was £2,335, and there was a loss of £323. This he attributed to undertaking work at too low a price, and also one or two bad workmen. The Deputy Official Receiver stated that in addition to the £200 overdraft, guaranteed by the debtor's father, the debtor had received advances to the amount of £2,400, whilst his deficiency was nearly £2,400, which meant that since February, 1927, £5,000 had gone. The debtor was asked for an explanation, and he replied that one cause was bad workmanship, for which he received no money, and cutting prices, and he added that it cost him three times the amount he had received. The debtor was ordered to prepare cash and trading accounts, and the examination was finally adjourned.

J. L. Whiting, 4, Portland Street, Newark, electrical engineer and contractor.—The public examination herein was held on October 3rd at Nottingham, when the debtor attributed his failure to want of capital and doing work at too low a price. He returned a statement of affairs showing gross liabilities of £498, of which £491 was expected to rank, and in the assets stock amounted to 10s. It appeared that there had been a complaint by two creditors that as the debtor was making a fair profit and doing work for good customers, they could not understand why he got into debt. The debtor was closely questioned regarding his daily routine, and, after a lengthy discussion, the examination was closed.

J. Hobson, electrical engineer, 1a, Thorncliffe Grove, Whitworth Park, and Cross Street, Pendleton, Salford.—Receiving order made September 26th on debtor's own petition.

H. Cohen (E. Cohen), electrical engineer, &c., 41 & 43, The Village, Lower Bebington, Chester.—Last day for proofs for dividend, October 15th. Trustee, Mr. J. Allcorn, Government Buildings, Victoria Street, Liverpool.

F. H. Graham, electrician, 14, Hilltop Avenue, Harehills, Leeds.—Receiving order made October 1st, on debtor's own petition.

W. J. Phillis, electrical engineer, 87, Overton Road, Leicester.—Receiving order made October 2nd, on debtor's own petition.

H. E. Daft, electrical engineer, Gloucester Place, Monument Street, Peterborough.—Receiving order made October 1st, on debtor's own petition.

Company Liquidations.

A. H. Seager, Ltd., electrical and wireless engineers, Orient House, Station Road, Belmont, Surrey.—The statutory meeting of the creditors of the above was held recently at the Parish Hall, Downs Road, Belmont, when Mr. H. K. Shersby, the liquidator, reported that the ranking liabilities were £2,560. In addition, there was a fully-secured creditor for £80, who held as security a car of the estimated value of £90. The net assets were £606. The company was registered in 1927 with a capital of £1,200, and was formed to take over the assets and liabilities of a wireless and electrical engineer. It was stated that during the 18 months that the company had been in existence it had traded at a loss. During the first six months the turnover was £695, but between December 1st, 1928, and May 31st last, the sales increased to £1,414. Recently the turnover had declined. The position of the company was attributed to underestimating for a contract. It was decided that the voluntary liquidation should be continued with the present liquidator, whilst an advisory committee of the principal creditors was also nominated.

Newcastle Electrical & Motor Accessories, Ltd.—Particulars of claims by October 16th to the liquidator, Mr. I. Nixon.

Private Arrangements.

Leonard Rowbottom, wireless dealer, 20a, High Street, Stourbridge.—The creditors of the above were called together on September 25th, when Messrs. Poppleton & Appleby, accountants, of 3, Warwick Passage, Corporation Street, Birmingham, submitted a statement of affairs showing liabilities of £379, and assets of £110. It was stated that the stock consisted mainly of various units used in the making up of sets, and was bought from the sale of a stock of another firm which ceased operations. The trading figures would seem to show that the debtor had not been working at a sufficient margin of profit to cover his overhead and personal expenses. The debtor commenced trading at High Street, Brierley Hill, in 1927, with a capital of about £60 in cash, and he also had stock of the value of £30. He had previously been employed by a wireless firm in the district. He managed to work up a fair business, but finally suffered through keen competition and the cutting of prices. The debtor had been pressed by creditors, and, on the advice of his solicitor, executed a deed of assignment to Mr. F. E. Bendall, of Messrs. Poppleton & Appleby. The creditors decided that the deed should be confirmed and the estate realised.

George Arthur Hodgson & Herbert Dennis, electrical engineers, &c., trading as G. A. Hodgson & Co., Stump Cross Works, Britannia Road, Morley, Yorks.—A meeting of the creditors of the above was held recently, when Mr. G. Astle, of 22, Park Row, Leeds, reported that the liabilities were £1,362, and the net assets £312. The debtor commenced trading in 1928 with a capital of £150, and last February was joined by Dennis, who, however, did not introduce any cash. A number of contracts had been carried out, and it was believed that losses had been sustained on some of them. A resolution was passed confirming the deed of assignment already executed to Mr. Astle, and a committee of the principal creditors also appointed.

Robert Taylor, electrician, 2a, Bo'ness Road, Grangemouth.—The creditors of the above were called together on September 26th at the offices of Messrs. McMillan & Henderson, when it was reported that the liabilities were £374, and the net assets £29. The estate showed approximately 1s. 6d. in the £. It was stated that the debtor had been trading for a number of years, having commenced with a capital advanced by his brother, who was the cash creditor shown in the statement. The drawings had been approximately £4 a week. In the absence of any offer, it was decided that the estate should be realised under a trust deed in favour of Mr. McMillan, whilst a committee was also appointed. The following are creditors:—

	£		£
Holland House Elec. Co., Ltd.	25	Walker Electrical Service	24
		Fotheringham, J. ...	27

New Catalogues and Lists.

Lisenin Wireless Co., 5, Central Buildings, High Street, Slough.—A folder illustrating radio positive grip plugs and sockets. Priced.

Erskine, Heap & Co., Ltd., Lancashire Switchgear Works, Caroline Street, Broughton, Manchester.—Pamphlets Nos. O.S. 24 and I. 23, describing, respectively, heavy duty oil circuit breakers and long-scale moving-iron instruments for a.c. and d.c. circuits.

Drake & Gorham Wholesale, Ltd., 67, Long Acre, W.C.2.—Pamphlet No. 470 of the company's electric fires, irons, kettles, &c., with illustrations and prices. The cover has a humorous picture entitled "The Traitor," showing a chimney-sweep in an armchair enjoying the comforts of an electric fire.

Mr. O. N. Beck, 11, Queen Victoria Street, E.C.4.—An illustrated leaflet drawing attention to the "Opifex" quick-closing blow-off valve.

Messrs. Joseph Kaye & Sons, Ltd., 93, High Holborn, W.C.1.—Leaflets Nos. 66 and 99, dealing, respectively, with the "K" oilcan and oil economisers.

Igranic Electric Co., Ltd., 149, Queen Victoria Street, E.C.4.—Two illustrated booklets, fully illustrated and priced, of the company's radio accessories; also a number of leaflets giving particulars of the neutrosonic short-wave receiver, the A.C. 3 receiver and radio-gramophone model; a 5-valve portable receiver, and the Super-Phonovox pick-up and tone arm.

Edison Swan Electric Co., Ltd., 123-5, Queen Victoria Street, E.C.4.—Four publications containing, with illustrations and prices, particulars of radio receivers, battery eliminators, chargers and power components, radio accessories and constructors' components, and "Mazda" radio valves.

Messrs. J. H. Tucker & Co., Ltd., Kings Road, Tyseley, Birmingham.—An illustrated price list of the company's switches and accessories.

Lighting Trades, Ltd., 30-31, Farringdon Street, E.C.4.—An electric lighting glassware catalogue containing numerous illustrations, with colour sections, of bowl, globe and shade fittings. The cover design combines simplicity with effectiveness.

Messrs. Thorpe & Bosco, Ltd., 38, Broad Street, Golden Square, W.1.—A neat booklet containing illustrations of several large electrical installations carried out by the company, and some sensible notes on electricity and electrical installations.

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Midland Electric Manufacturing Co., Ltd., Birmingham.—An illustrated folder drawing attention to the new "Memrex-Senior" ironclad switch and fuse gear which the company has recently produced.

Metro-Vick Supplies, Metro-Vick House, 155, Charing Cross Road, W.C.—Brochure No. 7102/8 illustrating "Cosmos" lamps for domestic and industrial purposes. Priced.

Chloride Electrical Storage Co., Ltd., Clifton Junction, nr. Manchester.—A publication entitled "Standby Power" dealing with the various uses of storage batteries on board ship with particular reference to "Exide" storage batteries. Some illustrations of vessels in which these batteries are installed are included.

General Electric Co., Ltd., Magnet House, Kingsway, W.C.—A leaflet setting out the advantages of "Osram" pearl lamps. Priced.

Calendar-blotters for October have been received from the Jackson Electric Stove Co., Ltd., 143, Sloane Street, S.W.; Messrs. Arthur Ling & Co., Ltd., 138, Fetter Lane, E.C.4; Messrs. Mavor & Coulson, Ltd., 47, Broad Street, Mile-End, Glasgow; Enfield Cable Works, Ltd., Lincoln House, 296-302, High Holborn, W.C.1; Pope's Electric Lamp Co., Ltd., Elasta House, 5, Arthur Street, New Oxford Street, W.C.; and Warren Bros. (Middlesbrough), Ltd., Middlesbrough.

Messrs. Chas. Lather & Co., Ltd., Moat Foundry, Tipton.—An illustrated and priced list of the company's fires, irons, boiling plates, &c.

Tungsram Electric Lamp Works (Great Britain), Ltd., 72, Oxford Street, W.—A folder drawing attention to Tungsram lamps. Illustrated and priced.

Furse Wholesale, Ltd., Traffic Street, Nottingham.—A net trade buyers' list (No. 24/29) of electrical supplies, apparatus and appliances.

Pope's Electric Lamp Co., Ltd., Elasta House, 5, Arthur Street, New Oxford Street, W.C.2.—A September price list of "Elasta" lamps.

Universal Manufacturing Co., 7c, St. George's Circus, S.E.1.—A card showing the colours with which the company treats lamps, &c.

Furse Wholesale, Ltd., Traffic Street, Nottingham.—Price list No. 24/29 of electrical supplies, apparatus and appliances.

Messrs. Ross, Courtney & Co., Ltd., Ashbrook Road, N.—A leaflet advertising the "Little Jackie" hydraulic jacks.

Messrs. C. H. Parsons, Ltd., Britannia Works, Wharfdale Road, Tyseley, Birmingham.—A comprehensive catalogue of "Britmac" switches and lampholders. Illustrated and priced.

Messrs. Galliers, 32, St. James' Street, Brighton.—The October number of this company's Electrical Bulletin deals with its exhibits at the Brighton electrical exhibition, now being held, and includes a list of broadcast items to be given during the current month.

Electric Incubator Heaters, Curfew Poultry Farm, Gogmore Lane, Chertsey.—A booklet giving details of the "Curfew" electric incubator heater. Illustrated and priced.

For Sale.

Tenders are invited for the purchase of generating plant at the Royal Air Force Station, Sealand, near Chester. East Retford Borough Council has for disposal Belliss & Morcom steam generating plant. (See our advertisement pages to-day.)

Electrical Exhibition at Kingston-on-Thames.

An electrical exhibition organised by the Kingston-on-Thames Corporation Electricity and Lighting Committee is to be formally inaugurated by the Mayor at Baths Hall, Wood Street, on October 14th.

The South American Mission.

Members of the Economic Mission to South America were expected to arrive at Southampton yesterday (Thursday) by the s.s. *Asturias*, after an absence of about two months. In addition to concluding a satisfactory trade agreement with Argentina, the Mission collected a great deal of useful trade information relating to Argentina, Brazil and Uruguay.

Prices of Materials.

Messrs. F. Smith & Co. and Messrs. James & Shakespeare report, October 8th: No change in copper prices.

Messrs. James & Shakespeare report, October 8th: English pig lead, £24 15s., 5s. dec.

Messrs. Edward Till & Co. report, October 8th: India-rubber, Para fine, 10½d., ⅛d. dec.

Messrs. James Forster & Co., reporting on October 5th, stated that owing to the lack of demand from consumers, the lead market last week sagged daily and prices closed at the lowest. The Producers' Association has been offering, but generally speaking, its price rules above the market level. It is expected that arrivals this month will be rather short, in fact warehouse lead has already been declared to meet consumers' requirements. However, the Australian shipments during September are reported to be 17,367 tons against 8,163 tons in August, so that any shortage of arrivals is likely to be only temporary. The position is sound enough and probably justifies the present level of prices.

Lighting and Power Notes.

Barking.—Loans.—The Urban District Council Electricity Committee is to apply for sanction to a loan for the wiring of houses on the Eastbury estate. Allowing for nine points per house, a loan of £2,682 will be required. The Committee has also obtained sanction to a loan of £3,000 for mains extensions.

New Cables.—The Urban District Council is to lay additional cables in the Hertford Road district, at a cost of £3,000.

Barnstaple.—Special Order.—The Rural District Council has given its consent to an application by the Ilfracombe Electric Light & Power Co., Ltd., for a Special Order to supply electricity to Morte-Hoe, Berrynarbor, Georgeham, Westdown, and Bittadon. The supply will be by means of overhead lines.

Birkenhead.—Loans.—The Corporation Electricity Committee has applied for sanction to loans of £2,500 for overhead distributing lines, £4,000 for feeders, £2,000 for sub-station equipment, and £1,500 for small static sub-stations and kiosks.

Blackpool.—Loan.—The Corporation has applied for sanction to a loan of £6,200 for feeder extensions.

Boston.—Supply Inauguration.—During the last few weeks a public electricity supply has been inaugurated in the towns of Long Sutton and Sutton Bridge, and the parishes of Fleet and Little Sutton. These districts are supplied from the Mount Bridge power station of the Boston and District Electric Supply Co., Ltd., by means of 11,000-V, 3-phase overhead lines, these lines being extensions from the Boston-Holbeach transmission line. The company is carrying out the street-lighting scheme at Long Sutton, the majority of the lamps being switched on on September 14th last. The whole of the public lighting at Holbeach has also been converted to electricity. The charges in the area are 8d. per kWh for lighting, 2½d. per kWh for small motive power, 2d. per kWh for heating and cooking, and 1½d. per kWh, plus a fixed quarterly charge under an "all-in" tariff.

Buckie.—Street Lighting.—The Town Council has approved a scheme for lighting the town by electricity at an estimated cost of £14,325. The scheme provides for buildings, plant, cables, the lighting of the streets and the harbour, and also the cost of the Order. The charges suggested at the outset are 8d. per kWh for lighting and 4d. for power and heating purposes.

Chapel-en-le-Frith.—Inauguration of Supply.—The ceremony of switching on the supply of electricity for Chapel-en-le-Frith, Whaley Bridge, Chinley and Disley was performed on October 3rd by Mr. W. H. Flanagan, ex-M.P. for the Clayton Division of Manchester. The scheme has been carried out by the Trent Valley and High Peak Electricity Co., Ltd., and is stated to have cost the company £40,000.

Chesterfield.—Price Reduction.—The charge for electricity for lighting has been reduced from 4d. to 3½d. per kWh.

Chichester.—Loan.—The Town Council is to apply for sanction to a loan of £10,000 for mains extensions.

Continental.—France.—The Société d'Electricité de Paris lately placed a contract with the Oerlikon Co. for a 75,000-h.p. steam turbine which is to be directly-coupled to a Jeumont alternator. The latter is to run at 3,000 r.p.m. and is to have a continuous capacity of 50,000 kW, generating at 10,500 V at a power factor of 70. The new plant is to be installed in the power station at Saint Denis, Paris. Steam at a pressure of 782 lb. per sq. in. superheated to a temperature of 842 deg. F. is to be used in three stages, that is, in one high-pressure, one medium pressure, and two low-pressure sections, all mounted on the same shaft and designed to run at 3,000 r.p.m. The turbine is being built with the stipulation that it must be capable of running continuously with steam at pressures between 710 and 850 lb. per sq. in. and occasionally at 995 lb. The set, including the exciter, will be not less than 98½ ft. in length and will weigh about 332 tons. The exhaust steam from the turbines will be condensed in four Delas-type surface condensers about 21 ft. in length and 6½ ft. in diameter.

Greece.—The Greek Ministry of Communications is inviting offers for the concession for the utilisation of the water-power resources of Macedonia for electricity generation purposes, and in particular the power of the Verria, Vodena, and Veldovo falls and the rivers Achelco and Aliakmon.

Doncaster.—Loan.—The Town Council is to apply for sanction to a loan of £10,750 for electrical equipment for the new Bemberg artificial silk works.

Eastbourne.—New Plant.—The Corporation Electricity Committee is applying for sanction to the borrowing of £16,000 for the provision of a 2,500-kW turbo-alternator, £16,000 for a new boiler, and £6,000 for the provision of a switchhouse.

Glasgow.—Housing Scheme Supply.—In connection with the supply of electricity to the Corporation's housing schemes, it has been decided to give notice to the Clyde Valley Electrical Power Co., that it is the intention of the Corporation to take over the distribution of the supply to the Shettleston and Tollcross areas at the end of the current year. Under the

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Order granted to the Clyde Valley Electrical Power Co., it had the right to supply these areas, but this Order was granted while they were under the Lanarkshire County Council. When the areas came within the boundary of Glasgow, the Corporation took over the agreement and is entitled on January 1st next to take over the distribution of the electricity supply. The Corporation must, however, continue to take the supply in bulk from the Clyde Valley Co.

Halifax.—New Cables.—The Corporation Electricity Committee has applied to the Unemployment Grants Committee for a grant towards the laying of new cables on the Hebden Bridge service, at an estimated cost of £7,961.

Hungerford.—Bulk Supply.—The power station has been closed down, and a bulk supply was recently formally inaugurated. The supply is provided by the Wessex Electricity Supply Co., Ltd., which arranged an electrical exhibition to demonstrate the uses of electricity in the home. The charge for lighting has been reduced from 1s. to 10d. per kWh.

Irish Free State.—Enniskillen (Co. Fermanagh).—The town was lighted by electricity for the first time when the electricity supply was switched on by Mr. Robert Proctor, the chairman of the Lighting Committee of the Urban District Council at the inauguration ceremony held recently at the power house.

The Shannon Scheme.—The Dublin correspondent of *The Times* reports that on October 5th, for the first time, electricity from the Shannon was used to light the centres of population comprised in the Leinster loop. The area embraces all Leinster towns from Waterford to the municipal boundaries of Dublin. A double transmission line connects Ardnacrusha with Dublin, and all power for Leinster will be distributed from the Dublin transmission station. The Leinster circuit is being tested at present, and afterwards power will be supplied to transmission lines in Munster and Connaught. It is hoped that the power station at Ardnacrusha will be put into commercial use before the end of the present month.

Lancaster.—Electricity Extensions Scheme.—The Corporation Electricity Committee has submitted to the Unemployment Grants Committee a scheme of cable and service extensions in the town estimated to cost £20,000, of which the Corporation would have to provide £12,500.

Leeds.—Loans.—The Corporation Electricity Committee has recommended application for sanction to loans of £175,000 for services and £50,000 for assisted wiring.

London.—Bermondsey.—The Borough Council Electricity Committee has decided that the official opening of the new sub-station shall take place on Saturday, October 26th, the ceremony to be performed by the Mayor.

St. Marylebone.—The Borough Council Electric Supply Committee is applying for sanction to a loan of £50,000 for mains and services and transformer stations on consumers' premises during the following two years.

With reference to its appointment of experts to report upon the precautions to be taken in connection with the operation of the generating station, the Electric Supply Committee has reported that it has interviewed the experts, informed them of the reasons which induced the Council to appoint them and outlined the Council's wish in the matter. It was agreed that the total fee payable to the four experts engaged should not exceed £1,600 for individual reports or a concerted report by the experts, and it is anticipated that such report or reports will be in the town clerk's hands not later than the end of the current month.

The Committee has also reported the receipt of a letter from the Electricity Commissioners stating that they have been in consultation with the Central Electricity Board and are given to understand that a bulk supply of electricity is not at present available for the Council's growing requirements, and that it would be advisable to proceed at once with the installation of a 25,000-kW turbo-alternator set, &c. The Board has intimated that it is prepared, subject to the approval of the Commissioners, to give its sanction to the proposed extensions.

Hackney.—The Borough Finance Committee has recommended that application shall be made for a loan of £9,823 for extensions to sub-stations and plant.

The Electricity Committee has recommended the laying of l.p. feeders at a cost of £8,205.

Maidstone.—Year's Working.—The accounts of the Corporation Electricity Department (engineer and manager: Mr. E. E. Hoadley) for the year ended March 31st last show a total revenue of £99,650, as compared with £94,367 in the preceding year, and a working expenditure of £52,741, as against £61,147, leaving a gross profit of £46,909 (£33,220). To the gross profit was added income from other sources, making a total of £47,830 available, and, after providing for capital and other charges, there was a net surplus of £13,719, as compared with £6,228 in 1927-28. The capital expenditure during the year amounted to £39,857, and included £18,036 for machinery and £11,654 for mains. The total now spent on the undertaking stands at £501,307. The sales of electricity increased from 17,573,183 to 21,086,246 kWh, and the maximum supply demanded from 7,235 to 7,710 kW.

Malaya.—Malacca.—Following the refusal of the Malacca Electric Lighting Co. to reduce the maximum charge for electricity to 30 cents per kWh, an attempt has been made to establish a rival electricity company. Sanction has, however, been refused by the Federal Commissioners, and the Chinese Chamber of Commerce is now organising a public petition to the Governor.

Oswestry.—Purchase of Undertaking.—At a special meeting of the Town Council, held recently, the Corporation decided to take over the undertaking of the Oswestry Electric Lighting and Power Co., Ltd., as from October 1st. The price of the undertaking is not yet fixed, but it was agreed that the staff of the company should be employed by the Corporation. It was also decided that the North Wales Power Co., Ltd., should be approached with regard to effecting a fresh agreement for a bulk supply.

Special Orders.—Application is being made to the Electricity Commissioners by Wigan Corporation for a Special Order authorising it to supply electricity in the urban districts of Standish with Langtree and Upholland, and part of the rural district of Wigan.

The Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising East Grinstead Urban District Council to supply electricity in part of the rural district of Godstone.

Stalybridge.—Loans.—The Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board is to apply for sanction to loans of £2,673 for excess expenditure on plant and plant foundations, £25,000 for mains, and £10,000 for transformers and switchgear on consumers' premises.

Stockport.—Inauguration of Bulk Supply.—The ceremony of switching on the bulk supply of electricity to an area including Macclesfield, Buxton, Poynton, New Mills, Chapel-en-le-Frith, and Marple was performed on September 30th by the chairman of the Corporation Electricity Committee. This is the first section of the Central Electricity Board's North-Western scheme to be completed.

Stranraer.—Street Lighting.—The Town Council has decided to grant the Holderness Trust, London, permission to apply for a Special Order to light the streets of the town at 2½d. per kWh.

Stretford.—Year's Working.—We have received from Mr. T. A. Kerr, engineer of the Urban District Council's Electricity Department, the accounts of the undertaking for the year ended March 31st last. The total revenue amounted to £201,271, as compared with £213,568 in the preceding year, and the working expenditure was £128,797, as against £135,580, leaving a gross profit of £72,474 (£77,988). To the gross profit was added income from other sources, making a total of £72,729 available, and, after payment of loan and other charges, there was a net surplus of £9,660, as compared with £24,082 in 1927-28. The capital expenditure during the year amounted to £28,054, the chief item being £21,557 for mains and services. The consumption of electricity for private power purposes increased from 49,322,389 to 51,526,154 kWh, and the total sales from 54,341,792 to 57,146,921 kWh. The maximum supply demanded rose from 18,040 to 19,244 kW.

Swinton.—Street Lighting.—The Urban District Council has decided to use electricity entirely for street lighting purposes, the installation to be made by the Rotherham Corporation. The Council is a partner with the Mexborough Urban District Council in a municipal gas undertaking.

United States.—Hydro-Electric Developments.—According to *Power* a permit granting water rights on the North River for the proposed $2,250,000 hydro-electric power project in Grays Harbour County, Washington, has been granted to the Western Washington Electric Light & Power Co., of Aberdeen, Washington. The undertaking, which will produce 54,545 theoretical h.p. and 25,000 installed electrical h.p., will require an appropriation of 5,000 sec. ft. of water from the flow of the North River, a tributary of Willapa Harbour. Rights were issued by the state hydraulics supervisor for the impounding of a total of 272,000 acre-ft. of water in a reservoir which will result from the construction of a concrete arch-type dam 153 ft. high, 400 ft. wide at the crest, and 180 ft. wide at the base. The development, to be completed on or before June 1st, 1932, will have its power plant situated at a stream point about ten miles south of the south shore of Grays Harbour, according to the plans. An application by the North-West Power Co., a subsidiary of the Portland Electric Power Co., Portland, Oregon, for rights along the river and Marion Lake is now pending. A joint hearing was held on September 24th before the State Reclamation Commission and the Federal Power Commission. The proposed development contemplates a storage project on Marion Lake, construction of a dam which will raise the waters of the lake nearly 70 ft., and a power plant on the North Santiam River, near Detroit, Oregon. It is proposed to develop 32,000 h.p. In the East tentative approval has been granted by the Federal Power Commission for the construction of a $10,000,000 hydro-electric and flood-control project on the Chattahoochee River, near West Point, Ga. When completed and tied into the existing power facilities of the West Point Manufacturing Co., about 100,000 h.p. will be available, it is estimated.

Weymouth.—New Electricity Charges.—The Town Council has adopted the following revised scale of charges within the borough:—Lighting, 6d. per kWh, with discount; heating,

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1½d. per kWh; power, 1½d. per kWh; water heating, ¾d. per kWh; cooking, ¾d. per kWh; domestic contract, ¾d. per kWh; business contract, 1½d. per kWh. An additional charge is made for electricity outside the borough.

Winchester.—Year's Working.—The report of the city electrical engineer (Mr. R. Ayton) on the working of the electricity undertaking for the year ended March 31st last records a total income of £38,191, as compared with £40,450, and working expenses of £19,831, as against £25,270, leaving a gross profit of £18,360 (£15,180). To the gross profit was added revenue from other sources, making a total of £19,038, and after deducting capital charges (£11,378), capital expenditure charged to revenue (£1,694), and £398 written off for depreciation, there was a net surplus of £5,568, as compared with £3,000 in 1927-28. The sales of electrical energy increased from 2,411,994 to 2,754,778 kWh, and the maximum supply demanded from 1,372 to 1,459 kW.

Tramway and Railway Notes.

Blackpool.—Tramway Employes' Wages.—The Transport Committee has instructed the Transport Officer to bring before the Municipal Tramways Association an application by the Transport Workers' Union for increased pay for employés engaged on one-man operated vehicles.

Bradford.—Year's Working.—We have received from Mr. R. H. Wilkinson, the general manager of the Corporation tramway undertaking, a copy of his report together with the statement of accounts for the year ended March 31st last. The total revenue amounted to £568,052, as compared with £597,281 in 1927-28, and working expenses were £458,412, as against £470,849, leaving a gross profit of £109,640 (£126,433). The railless-car system showed a total income of £54,299, and working expenses of £51,551, leaving a gross profit of £2,748. The figures for the preceding year were: Income, £45,372; working expenses, £44,523; gross profit, £849. The motor-omnibus system and the Parcels Department recorded gross profits of £13,870 and £1,157 respectively, and these, with the gross profits from the tramway and railless-cars, and revenue from other sources, were carried to net revenue account, making a total of £147,000 available. Capital and other charges absorbed £137,360, and there was a net surplus of £9,640, as compared with £34,288 in the previous year. The capital expenditure during the year amounted to £102,612, the chief items being £32,189 for permanent way, £11,580 for railless-cars, and £52,963 for 'buses. The number of passengers carried increased from 112,367,506 (tramways 96,860,739, railless-cars 7,029,025) to 116,435,647 (tramways 93,589,130, railless-cars 8,532,938), and the car-mileage from 9,411,147 (tramways 7,356,775, railless-cars 905,069) to 10,376,868 (tramway 7,313,725, railless-cars 1,081,848). The total revenue per car-mile fell from 18.246d. to 17.138d.

Burnley.—Superannuation Scheme.—An application was made recently by the tramway manager, on behalf of members of his staff, taken over by the Corporation when the undertaking was purchased from the Tramway Company in 1901, that they should be included in the new scheme of superannuation. Application was also made for an increase in superannuation allowance payable for non-contributory service, or, alternatively, an extension of the period of service. The Corporation has refused both these requests.

Chatham.—Tramway Abandonment.—It was reported at a recent meeting of the Rochester Town Council that negotiations had been concluded and terms arranged with the Chatham and District Light Railways Co. for the removal of the tramway system. It was also stated that the Ministry of Transport had intimated that it was prepared to make an Order authorising the abandonment of the tramways, and the substitution of 'buses. The company has suggested September 30th, 1930, as the date for the abandonment of the trams.

Continental.—Lithuania.—The question of the construction of an electric tramway at Kaunas has been considered by a committee of engineers and the Lithuanian Home Office. The latter has decided that the proposal made some time ago by a German firm, to build the tramway at once, with lines throughout the city, is unacceptable, and approves a plan whereby the City Board itself will build the tramway gradually. In the first place, it is proposed to run the line from the railway station to Panemuné, where it will be possible to utilise the rails of the present light railway.—*Reuter's Trade Service.*

Switzerland.—The budget of the Swiss Federal Railways for 1930 includes provision for 75 new electric locomotives and motor-equipped carriages.

Glasgow.—Doubling of Track.—The Corporation Tramways Committee has recommended that application be made for sanction to double the tramway track in High Street, Renfrew.

Passenger Traffic Monopoly.—The Corporation is to make application in December next for a monopoly of the road passenger traffic within the city and on tramway routes outside the city.

Ilford.—Year's Working.—The report of Mr. L. E. Harvey, engineer and manager of the Borough Tramways Department, on the working of the undertaking for the year ended March 31st last records a total revenue of £77,456, as compared with £77,595 in the preceding year. Working expenses amounted to £58,994, as against £57,880, leaving a gross profit of £18,462 (£19,715), to which was added income from other sources, making a total of £21,574 available. After deducting capital and other charges, there was a net surplus of £7,725, as compared with £8,674 in 1927-28. The number of passengers carried increased from 15,829,480 to 15,880,953, and the car-miles run from 1,076,378 to 1,111,686. The average total revenue per car-mile fell from 17.301d. to 16.722d.

Leeds.—Tramway Construction.—The Corporation Tramways Committee has referred to the Parliamentary Committee the question of including in the next Bill to be promoted by the Corporation in Parliament provisions for the purpose of (*a*) extending the time allowed for the construction of the section of the tramway from Selby Road, and (*b*) authorising the construction of tramways from Roundhay Road to Hollin Park, *via* Easterly Road, West Street, to Wellington Street, *via* St. Phillip's Street, and Kirkgate to New York Street, *via* Harper Street.

Tramcar Construction Scheme.—The Corporation Tramways Committee has referred the scheme for the construction of 150 tramcars for replacements to the Industrial Conditions Committee, as suitable to be carried out for the relief of unemployment with the assistance of grants from the Government.

London.—Piccadilly Circus Station.—Large electric light standards are now replacing the smaller type of standard at Piccadilly Circus Station. Each standard gives a total of 500 candle-power, as against 200 in the older type. They will be installed upon all the sites now occupied by the smaller standards on the lower landings. The new form of lighting fitting consists of a bronze column which broadens into a basin at the top, like a fountain, and is surmounted by a large reflector.

The Underground's Winter Programme.—On Monday last, October 7th, the Underground Companies introduced their winter programme of improved train services. Compared with last winter, there are 112 more cars running. The speed of trains on all lines has been increased, and closer interval services provided. The improved running times have been made possible by the trains being fitted with new and more powerful motor equipment. Improvements in the signalling installations have made shorter headways possible.

Lytham-St. Anne's.—Inquiry into Administration.—At a meeting of the Town Council, held recently, the Mayor referred to the decision of the Tramways Sub-Committee recommending the re-appointment of a special committee to inquire into the affairs of the department, and said this move was taken because they were not satisfied with the tramways. The committee would look into matters to see if an improvement could be introduced. During the year the Tramways Department had lost several thousands of pounds, and the general impression was the position should be investigated.

Manchester.—Tramway Extensions.—The Corporation Tramways Committee has given instructions for the work of constructing the tramway along Aytoun Street to be proceeded with.

Portsmouth.—Traffic Noises.—A special committee has been appointed to inquire into the question of noise and vibration caused by trams and other vehicles in certain streets in the city.

York.—The Future of the Tramways.—In a report prepared with regard to future transport within the city, the tramway manager advises that in order to reduce the capital debt the tramway service should be maintained for a further ten years. He suggests that, if a route becomes worn out it should be abandoned and a railless-car service substituted. In presenting the report the Tramways and Motors Committee states that it is not prepared to make any recommendation as to what system should be adopted when the trams are discontinued. It recommends, however, that the Committee should be authorised to sell its Piccadilly car depôt, to obtain tenders for a new garage at Fulford, and to discontinue the present railless-car services at the end of the current year and replace them by motor-omnibuses.

Electricity in Swedish Horticulture.

According to the British United Press, electricity is extensively used in Sweden for horticulture, for heating the earth, and as a substitute for sunlight.

In the experimental garden at Hemlingby, on the north-east coast of Sweden, 10,000 tulips, 1,500 lilies of the valley, and 1,500 hyacinths were grown with the aid of electricity last January, and the cost of the current used was found to be about 1 per cent. of the value of the plants.

As a substitute for sunshine the use of electricity is still in the experimental stage, and is a more difficult problem, owing to the varying sensibility of plants to different kinds of light, but important and encouraging results have been achieved. It is hoped that natural climatic conditions can thus be overcome.

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Telegraph and Telephone Notes.

China.—Automattic Telephony.—One of the oldest cities in the world, Canton, has recently put into service the most modern type of automatic telephones. The China Electric Company, a subsidiary of the International Telegraph and Telephone Corporation of New York, installed the system for 4,000 lines.

International Telephony.—The Riviera.—Communication between the littoral beyond Marseilles and the rest of France has not hitherto been all that it should be. Owing to the increasing importance of the Riviera towns, which are now as full in summer as in winter, it was decided to lay an underground telephone cable to link Marseilles with Cannes, Nice, Monaco, and Mentone, and connect with the new underground cable from Paris to Marseilles. The new Riviera circuits will be completed a year from now, when it should be possible to ring up London from Cannes or Nice without difficulty. Meanwhile the authorities are effecting immediate improvements in the service; seven lines will link Paris with Nice during the coming winter, instead of four, and two lines will connect the capital with Cannes.—*Reuter's* (Paris).

South America. — Ericsson Telephones. — The L.M. Ericsson Telephone Co. has made rapid progress in Latin-America, according to a statement by the director of the company, Mr. K. F. Wincrantz, who, on his return from a long journey abroad to Stockholm, said that the company's concession in the Argentine had been considerably extended. In the north-western part of that country a new automatic telephone system would be built. In Mexico the number of subscribers on the company's automatic telephone network was growing, and by the end of this year would have reached 40,000. The company had recently acquired a large new telephone system in the northern and western parts of Mexico. Important negotiations for new concessions in other Latin-American countries were at present being carried on.

The Telephone Service.—Police Call Boxes.—Progress is being made with the scheme to provide a network of police telephone boxes throughout the 700 square miles of the metropolitan police area; between 800 and 1,000 boxes are to be installed.

Twenty-one boxes have been erected in the Richmond (Surrey) district, and it is hoped that they will be in use before Christmas. Twenty boxes are also being set up in the Wood Green, N., area. The majority will be in the outer areas of London, but there will be a number at important strategic points in the inner areas. Similar boxes have proved of considerable value in provincial towns, while there has been great saving in the closing down of sub-stations. They are intended to serve as sub-headquarters for policemen on their beats. In case of emergency, the central station will be able to get into touch immediately with the men by switching on lamps which can be seen through the glass panels of the boxes.

Cheaper Trunk Calls.—Substantial reductions in the rates for all trunk telephone calls over distances exceeding 200 miles between places in Great Britain, Northern Ireland, and the Isle of Man became effective on October 1st. Some adjustments will be also made to charges for calls in the afternoon period, over distances of from 100 to 200 miles.

The " personal call " system, which was introduced in the trunk and toll services in this country on August 1st last, has been extended to all the Anglo-Continental telephone services, except that with Switzerland.

Radio Notes.

Regional Stations.—South-Eastern Area.—It is expected that the Brookman's Park station will radiate the whole of the London programme (2LO), 842 kc., 356.3 metres, by the end of this month, when the London Oxford Street transmitter will be shut down. When the alternative transmitter will be ready to operate at 1,148 kc. (261.3 metres) has not yet been settled.

Northern Area.—The site of the north regional transmitter has been chosen at Moorside Edge, near Huddersfield; building operations are to commence at once, and the station will contain two transmitters of similar design to those at Brookman's Park. It is expected that its two frequencies will be 626 kc. (479.2 metres) and 995 kc. (301.5 metres), the separation, therefore, being 369 kc. The frequency of 626 kc. 479.2 metres) is being allotted to Manchester as it is the lowest of the Corporation's exclusive frequencies (with the exception of that of Daventry, 5XX), and, therefore, particularly suitable for service in the hilly and exceptionally populous country within 100 miles radius of Huddersfield. It is not expected that the Manchester station will be completed and working on a service basis until the end of 1930. *World-Radio* recalls the fact that in June last the Newcastle station was moved up temporarily from 1.230 kc. (243.9 metres) to 1,148 kc. (261 metres), and points out that it would be impossible to reserve an exclusive frequency for Newcastle for the whole of the time during which the regional scheme is being introduced. Thus, it becomes necessary temporarily to add Newcastle to those stations already working on the national common frequency 1,040 kc. (288.5 metres), which change will take effect on October 31st. During the period between October 31st and the opening of the plant at Moorside Edge, no programme can originate at Newcastle through its own transmitter only, due to the synchronisation of its wavelength with those of other stations in the North. It is intended, however, to include distinctive local features for radiation by all stations of the northern group working on the frequency of 1,040 kc. As soon as the new twin-wave transmitter at Moorside Edge takes over for the North of England, a frequency will be made available for Newcastle which will allow the transmission of programmes locally.

Scottish Area.—Various sites for the Scottish regional transmitter are being investigated. It is probable that building operations will begin for the Scottish station before the Manchester regional station is completed. Similarly, it is hoped to start work on the West regional station before the Scottish station is completed. The order in which the stations are being built has been decided in accordance with the density of the population falling within their respective service areas, and also upon the service already provided in the various districts by the old system of distribution.

Midland Area.—The Corporation has received some inquiries concerning the future of Daventry (5GB). The intention is to maintain it, based on Birmingham, as the transmitter for the Midlands. There is, of course, no intention of closing down Daventry, 5XX.

Television.—B.B.C. Transmission.—The first public test of the Baird system of television was made on September 30th, when a programme was broadcast from 2LO between 11 and 11.30 a.m. Sound and sight were broadcast alternately, as only one wave-length was available. Listeners using ordinary receiving sets heard the announcements accompanying the tests, but there was only a deep drone while the face of the speaker was being transmitted by land line from Mr. Baird's offices in Long Acre, to the B.B.C. control room, and from there to its Oxford Street transmitter. The tests will continue from 11 to 11.30 a.m. daily, except on Saturdays and Sundays.

Wave-lengths.—International Classification.—The International Consultative Committee for the Technique of Radio-Electric Communication has classified wireless wave-lengths as follows:—

	Metres.
Long	3,000 and upwards
Medium	200 to 3,000
Intermediate	50 to 200
Short	10 to 50
Ultra-short	Beelow 10

The committee recommends that, to prevent interference, the regulations drawn up at the Washington Conference last year for limiting the power of transmitters in North America should be generally applied.

The Royal Commission on Transport.

According to *The Times*, the Royal Commission on Transport met in public on October 4th and heard evidence given on behalf of the London County Council. Sir Arthur Griffith-Boscawen presided. Mr. C. W. Matthews, chairman of the Highways Committee of the London County Council, said that the Council was convinced of the vital part which tramways necessarily played in the provision of adequate means of transport for Greater London. While the Council's tramways carried an average of some 2,000,000 passengers a day, no fewer than 800,000 had to be carried within about four hours of the day. Large crowds were more easily transported by the tramways than by railway or omnibus, and at a cheaper rate per head. Referring to risks to passengers, the witness said that in Glasgow and Edinburgh there were by-laws making it an offence for vehicles to pass a tramcar on the near side when it is picking up and setting down passengers. There was no power to make by-laws of that kind in England and Wales. The number of accidents of this kind in London had grown between 1919-20 and 1928-29 from 8 fatal and 137 non-fatal to 13 fatal and 818 non-fatal cases. The Council considered that the existing measures for safeguarding passengers were inadequate. The relief from omnibus competition had been disappointing. A reduction in the number of omnibuses on routes served by the Council's tramways had taken place only on the Clapham route, where ten omnibuses had been eliminated. There was no restriction on Sundays. On the other hand, the capacity of omnibuses had increased and the Council thought that the Minister of Transport should exercise with greater energy the power conferred on him by the London Traffic Act of 1924 to reduce omnibus competition. For the financial year 1929-30, it was estimated that there would be a net surplus of £40,899 on the operation of the tramways. The next public sitting of the Royal Commission will be on October 29th.

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Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Argentina.—Buenos Aires.—November 4th. Argentine State Railways. Turbo-generator sets and headlights for locomotives. (B.X. 5657.)*

Australia. — Melbourne. — State Electricity Commission. December 16th. Oscillograph equipment. (B.X. 5692.)*

Posts and Telegraphs Department. November 12th. Telephone receivers and parts. (B.X. 5656.)* Transmitters and parts. (B.X. 5653.)*

November 19th. Telephone generators and motor-generators. (B.X. 5662.)*

November 19th. Motor-generators. (B.X. 5694.)*

November 26th. Vitreous resistances. (B.X. 5696.)*

November 27th. City Council. 6,600-V, 3-phase switchgear. (B.X. 5708.)*

Sydney.—October 29th. New South Wales Government Railways. Railway traction motor-testing equipment. (B.X. 5693.)*

Belfast.—October 21st. Electricity Department. Supply and delivery of circulating water pipes. October 4th.

Cardiff.—October 21st. Electricity Department. Supply and erection of a water-tube boiler, mechanical stokers, and fuel economiser. (October 4th.)

Edinburgh.—October 14th. Parish Council. Electric light and power installations at Crayleith Hospital. Forms of tender from Mr. J. M. Johnston, 47, Charlotte Street, Leith.

Egypt.—Cairo.—November 19th. Ministry of the Interior. One Diesel-electric generating set for the Manfalout power station. (B.X. 5720.)*

November 5th. Department of Public Health. Electric refrigerators for 12 months.

Hastings.—October 23rd. Electricity Department. 22,000-V, 3-phase overhead lines and underground cables, Crowhurst Section, No. 6 (approximately 7,000 yards). 400-V, 3-phase, 4-wire overhead lines and underground cable, Crowhurst Section No. 7 (approximately 4,200 yards). 400-V, 3-phase, 4-wire, overhead lines and underground cable, Whatlington Road, Section No. 8 (approximately 1,000 yards). (October 4th.)

India.—Delhi.—December 3rd. India Stores Department. Ceiling and table fans. (B.X. 5672.)*

London.—Southwark.—October 22nd. Borough Council. Electric cable for 12 months. (September 13th.)

Central Electricity Board.—November 9th. Supply, delivery, and erection of 33,000-V overhead transmission lines in South Lincolnshire. (September 27th.)

H.M. Commissioners of Works.—October 22nd. Supply of steel conduits and fittings for electric wiring, and cable and wire. (See this issue.)

Manchester.—October 15th. Board of Guardians. Electric lamps. Tender forms from Mr. F. W. Greenhalgh, Clerk to the Guardians, Union Offices, All Saints', Manchester.

October 23rd. Electricity Committee. Supply, delivery and erection of four 33,000-V, 500,000-kVA rupturing capacity switch units, and two 10,000-kVA, 33,000/6,600-V indoor-type transformers. (October 4th.)

New Zealand.—Wellington.—Post and Telegraph Department. November 12th. Four-conductor operator cords. (B.X. 5685.)*

November 18th. Resistance spools. (B.X. 5716.)*

November 19th. Telephone transformers. (B.X. 5718.)*

Automatic wall and table telephones. (B.X. 5717.)*

October 21st. Switchboard cords. (B.X. 5715.)*

Public Works Department. November 12th. 15-kW oil-engine-driven generating set for installation on the "Main Pomare." (B.X. 5683)*

Auckland.—Auckland Electric Power Board. November 4th. Distribution pillar shells and link units and cable sealing ends. (B.X. 5682.)*

Sheffield.—October 14th. Health Committee. Maintenance of private telephone and bell installations at Lodge Moor, Winter Street, Crimicar Lane, and Commonside Hospitals. Form of tender from Steward, Lodge Moor Hospital.

South Africa.—Johannesburg.—October 26th. City Council. Time switches. (B.X. 5709.)* Three-phase, 6,600-V truck-type switchboard panels. (B.X. 5710.)*

October 31st. Three-phase and single-phase outdoor transformers. (B.X. 5736.)*

Staffordshire.—October 31st. Education Committee. Installation of electric light in two new elementary schools in course of erection at Brierley Hill. (September 27th.)

Wakefield.—October 15th. West Riding Education Committee. Installation of electric light at Thurlstone new schools. Particulars from the Education Officer, County Hall, Wakefield.

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Birkenhead.—Electricity Committee. Accepted:—
6,500 yd. l.p. cable (£889).—W. T. Glover & Co., Ltd.
1,000 yd. l.p. cable (£349).—Hackbridge Cable Co., Ltd.
1 mile v.i.r. cable (£141).—Liverpool Electric Cable Co., Ltd.

Colchester.—Tramways Committee. Recommended:—
Electrically-driven oil filter.—Davey, Paxman & Co., Ltd.

Devizes.—Rural Council. Accepted:—
Installing electric light in 36 houses (£189).—A. R. Fox (Chippenham).

Dewsbury.—Borough Education Committee. Accepted:—
Installing electric lighting at the Walker infants' school.—F. Hirst.

Glasgow.—Tramways Committee. Accepted:—
Copper bonds.—T. Bolton & Sons, Ltd.

Halifax.—Tramways Committee.
Three complete tramcars, with air-brake equipment (£6,609); four separate equipments (controllers, motors and magnetic brakes) (£2,316); four M. and T. air-brake equipments (£722).—English Electric Co., Ltd.

Irish Free State.—Dublin.—Local Government and Public Health Department:—
Electric lamps.—Siemens Electric Lamps & Supplies, Ltd.; and Sphinx Electric Supplies (Ireland), Ltd.

Leeds.—Electricity Committee. Accepted:—
Galvanised steel tanks (£423).—Cochrane & Co.; (£690), J. R. Marsden & Co.
Cast-iron and galvanised-iron pipework (£2,235).—J. R. Marsden & Co.
Cables.—W. T. Henley's Telegraph Works Co., Ltd. (£2,015); Enfield Cable Works, Ltd. (£2,718); Macintosh Cable Co., Ltd. (£3,090); and Hackbridge Cable Co., Ltd. (£687).

London.—St. Marylebone.—Electric Supply Committee. Annual contracts:—
Transformers.—Metropolitan-Vickers Electrical Co., Ltd.; British Electric Transformer Co., Ltd.
Switchgear.—Ferguson, Pailin, Ltd.; A. Reyrolle & Co., Ltd.
Meters.—Chamberlain & Hookham, Ltd.; Ferranti, Ltd.

Edmonton Union.
Electric lamps.—Edison Swan Electric Co., Ltd.

War Office.—
Vacuum and gasfilled lamps.—Edison Swan Electric Co., Ltd.

Manchester.—Electricity Committee. Accepted:—
Steam-heating pipework at Dickinson Street station.—Stewarts & Lloyds, Ltd.
Pulverised-fuel boosting plant for Stuart Street station.—Alfred Herbert, Ltd.
Maintenance of 33-kV feeder cables.—Callender's Cable and Construction Co., Ltd.
Supervisory control gear and one 5-kW motor-generator, with control gear.—Metropolitan-Vickers Electrical Co., Ltd.

Tramways Committee. Accepted:—
Thermit welding of tram rail joints.—Murex, Ltd.
Internal rail bonds.—T. Bolton & Sons, Ltd. (per Collier Bros.).
Round flexible face rail bonds.—British Insulated Cables, Ltd.
Steel tramway poles.—British Mannesmann Tube Co., Ltd.

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Education Committee. Accepted :—
Electric cooker for Soss Moss special school.—Jackson Electric Stove Co., Ltd.
Electrical installation at Cooke Street domestic centre.—John Adams, Ltd.
Motor-generator set for Central High School for Boys.—Mather & Platt, Ltd.
Electric lighting installation.—A. Loudon.

Reigate.—Town Council. Accepted :—
H.p. feeder cable from the electricity works at Redhill (£1,574).—Callender's Cable & Construction Co., Ltd.

Rotherham.—Board of Guardians. Accepted :—
Electrical sundries.—Lilleker Bros.

Forthcoming Events.

Brighton Corporation Electrical Exhibition.—The Dome, Brighton. October 10th to 19th.

Institution of Engineering Inspection.—Friday, October 11th. Royal Society of Arts, John Street, Adelphi, W.C. 5.30 p.m. "The Chemical Laboratory in Inspection." Mr. E. F. Law.

Junior Institution of Engineers.—Friday, October 11th. 39, Victoria Street, S.W. 7.30 p.m. "Coal and Coal Cleaning." Mr. R. H. Allen.

Nottingham Society of Engineers.—Friday, October 11th. Mechanics' Institution, Nottingham. 7.30 p.m. Annual general meeting.

Institution of Engineers and Shipbuilders in Scotland.—Friday, October 11th, Grosvenor Restaurant, Gordon Street, Glasgow. "James Watt" dinner.

Association of Mining Electrical Engineers (South Wales Branch). — Saturday, October 12th. At Treforest. "Cotton in Engineering." Mr. J. B. J. Higham.
(Western Sub-Branch).—Saturday, October 12th. Swansea. Address by the chairman, Mr. S. T. Richards.

Institute of Transport.—Monday, October 14th. Institution of Electrical Engineers, Victoria Embankment, W.C. 5.30 p.m. Inaugural address by the President, Air Vice-Marshal Sir W. Sefton Brancker.

Association of Supervising Electrical Engineers.—Tuesday, October 15th. Junior Institution of Engineers, 39, Victoria Street, S.W. 6.30 p.m. Presidential address. Mr. S. B. Donkin.

Manchester Wireless Exhibition.—October 16th-26th. City Hall, Manchester.

Institution of Electrical Engineers, (Sheffield Sub-centre).—Wednesday, October 16th. Royal Victoria Hotel, Sheffield. 7.30 p.m. Address by the Chairman, Mr. H. W. Walker and smoking concert.
(North-Eastern Students' Section).—Friday, October 11th. Armstrong College, Newcastle-on-Tyne. 7.15 p.m. Inaugural address by the chairman, Mr. V. A. H. Clements.
(Western Centre).—Monday, October 14th. South Wales Institute of Engineers, Cardiff. 6 p.m. Chairman's inaugural address by Mr. S. B. Haslam.

Overhead Lines Association.—Wednesday, October 16th. Institution of Electrical Engineers. Annual general meeting. 5.30 p.m. Discussion on "Wayleave Agreements."

Institution of Mechanical Engineers.—Thursday, October 17th. Annual dinner. Friday, October 18th. Institution, Storey's Gate, S.W., 6 p.m. Presidential address by Mr. D. Adamson.

British Institute of Radiology, incorporating the Röntgen Society.—Thursday, October 17th. 32, Welbeck Street, W. 8.30 p.m. Ordinary meeting.

International Motor Show.—October 17th-26th. Olympia, W.

Birmingham Electric Club.—Friday, October 18th. Grand Hotel, Birmingham. 7 p.m. Ladies' night.

British Electrical Development Association. — Friday, October 18th. Royal Society of Arts, John Street, Adelphi, W.C. 7.30 p.m. "Personal Salesmanship in the Electrical Industry." Miss G. Burlton.

Electrical Power Engineers' Association (Southern Division).—Saturday, October 19th. Hotel Cecil, Strand, W.C. 5.30 p.m. Annual dinner.
(Glasgow Section).—Friday, October 11th. "A.c. Meters." Mr. R. J. Rennie.
(Manchester Section). — Saturday, October 12th. Cheetham Town Hall. 6.30 p.m. Social evening and dance.

The Batti-Wallahs' Society.

The next luncheon of this Society takes place on Thursday, November 7th, at 12.30 for 1 o'clock p.m. Mr. Frank Hodges will deliver an address.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following :—

Ancilla help-mate fire bars.

Saxonia electric meat chopper.

We also have an inquiry for the name of a wireless firm using as trade mark the letters "E" & "L" separated by a cross.

Notes.

Physical Society Exhibition.

The twentieth annual exhibition of electrical, optical, and other physical apparatus is to be held by the Physical Society and the Optical Society on January 7th, 8th and 9th, 1930, at the Imperial College of Science and Technology, South Kensington, London. As on previous occasions, there will be a trade section and a research and experimental section, and, in addition, a new section for the work of apprentices and learners is to be introduced. The Exhibition Committee invites offers from research laboratories and institutions, and from individual research workers of exhibits suitable for inclusion in any of the above three groups. Offers of exhibits, giving particulars of space and other facilities required, should be communicated not later than October 30th to the Secretary, Exhibition Committee, 1, Lowther Gardens, Exhibition Road, London, S.W.7.

Diesel Engine Users' Association.

Before a well-attended meeting of the Diesel Engine Users' Association on October 4th, Mr. Gerald B. Fox read a paper on "Indicating Oil Engines." Beginning with the manipulation of the indicator, he described the adjustment and cleaning thereof for use, the arrangement of the drive, the actual taking of the diagram, and concluded by describing a few types of indicator, including the "Mathot," "Gale," Farnboro," and optical indicators. A keen and interesting discussion followed, in which a number of members and visitors participated.

Overhead Lines Association.

At the conclusion of the formal business of the annual general meeting of the Association on October 16th, a discussion will take place at the Institution of Electrical Engineers, London, at 5.30 p.m., on the subject of wayleave agreements.

Fatality.

At Dunfermline on October 3rd the circumstances of the death of a colliery fireman, who received a fatal electric shock while working in the No. 2 Pit of Mossbeath Colliery, Cowdenbeath, were inquired into. A work mate said he saw sparks coming from an electric motor driving a fan, and found deceased lying at the machine. Robert Cuthbert, an electrical engineer in the employment of the Fife Coal Company, said he put in the fan five days before the accident. It was in good condition at that time. In his opinion deceased must have touched a bare conductor, but this was not discovered until the machine was examined in the workshop, when Mr. Roberts, the Government Inspector, found a bare spot. David Middleton, foreman electrician, said that the fault which was discovered was not one which made the machine "live" at all periods, but only intermittently. Mr. J. A. B. Horsley, H.M. Electrical Inspector of Mines, said he saw certain portions of the machine, but he did not see the most vital part, because the stator had been rewound. He had come to the conclusion that the fan was mechanically defective at the time it was installed. He did not, however, associate the mechanical defect directly with the fatal accident. With regard to the electrical defects, his assumptions were that the insulation of the end-coils where it was pressed upon by the end bell was at several places brittle and fragile through age and usage. It was probable that there was temporary and intermittent contact between one of the bare places and the end bell, causing the motor casing and the fan casing to become "live" at the moment when deceased touched it. To the formal verdict the jury added that, in their opinion, the accident was due to a defect in the insulation of a coil of an electric motor.

The Rationalisation of Industry.

Mr. A. P. Young, O.B.E., M.I.E.E., M.I.A.E., manager of the Rugby Works of the British Thomson-Houston Co., Ltd., is reading a paper on "Rationalisation of Industry," before the Rugby Engineering Society, on Wednesday, October 16th, at the Benn Buildings, Rugby.

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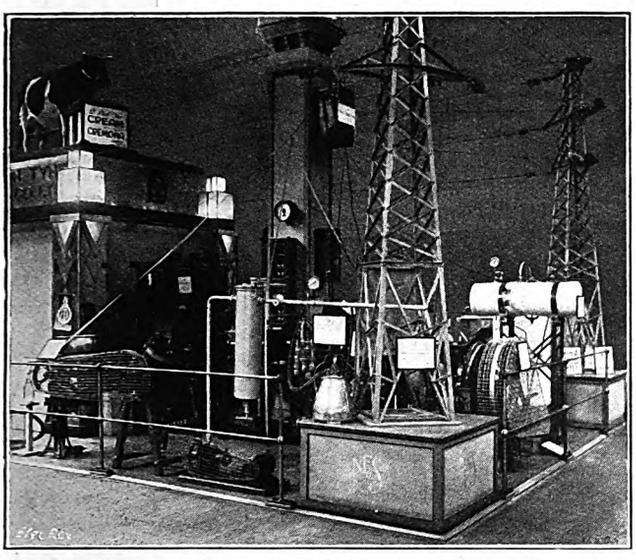
North-East Coast Exhibition.

The Newcastle-upon-Tyne Electric Supply Co., Ltd., informs us that it has now been decided to continue the agricultural section of its stand (No. 550 in the Palace of Engineering) until the Exhibition closes on October 26th. The Company has, therefore, re-arranged the existing apparatus, and added a farmer's bench containing a small circular saw, by A. Ransome and Co., Newark, driven by a 3-h.p. motor; a small band saw by the same firm, suitable for cutting either wood or metal, and driven by a 1/3-h.p. motor; and a combined portable and bench drilling machine and vice.

The main addition, however, consists of a 55-gallon per hour



Agricultural Section of the Newcastle Electric Supply Co.'s Stand at North-East Coast Exhibition.

combined cooling and refrigerating plant, by the Wessex Refrigerating Plant, Ltd., by means of which the milk is cooled from 95 deg. F., at which temperature it leaves the cow, to 36 deg. F., when it is ready for bottling or filling the churns for sending to the retailer. This machine, which is driven by a 2½-h.p., three-phase motor, is causing a great deal of interest, as, even with the additional cooling by means of the refrigerant not be desired, the water-cooling portion will reduce the temperature of the milk to within 5 deg. of the cooling water. Further, the machine, by means of the three-way cocks provided, can be utilised for connection to cooling and cold-storage chambers.

The Exhibition of Inventions.

At the International Exhibition of Inventions, which has been held during the current week at the Central Hall, Westminster, under the auspices of the Institute of Patentees (Inc.), there are a number of exhibits of electrical interest. A range of electric lamp locks is shown by Messrs. J. A. Brook, including the "Klip-Lamplok." This is a simple, but effective, device for use with bakelite holders, and consists of a narrow semi-circular band which is sprung round the holder and clipped into the lamp-pin slots. This company is also exhibiting its "Super-sparker," which is fitted to the dashboard of a motor car and indicates ignition and carburation troubles whilst the car is in motion. The St. James's Electrical Co., is showing its patent electric mains bells for fire alarms, domestic, mines, and industrial purposes, and lamp signalling, indicating systems, and time-limit switches. Illuminated advertising letters form the feature of the display of Messrs. G. S. Walliker and Son. These are constructed on the open-trough system, but a distinctive feature is the concealment of the lamps within the letters, leaving a clear unbroken announcement on the surface. By this means it is claimed that better lighting is obtained with only half the number of lamps required for the system in which lamps are exposed. W. R. Patents, Ltd., is exhibiting a number of devices for the detection of explosive gases and vapours, including the "Ringrose" gas sentinel, gas operated electric cut-offs, and fire-damp alarms. The display also includes the "Ringrose" miner's safety lamp. The Sellers Super-Vacuum Cleaner, Ltd., is demonstrating its vacuum cleaners, and Mr. O. Overbeck is showing electric rejuvenators. Electrically-operated advertising devices and signs are exhibited by Mossops (London), Ltd.

The Association of Supervising Electrical Engineers.

The opening meeting of the 1929-30 session is to be held on October 16th at the Junior Institution of Engineers, Victoria Street, S.W. Mr. B. C. Garman, chairman of the Association, will preside, and Mr. S. B. Donkin, who has consented to act as president for a further term, will deliver his presidential address. The subject of the address will be "The Production of Power from Natural Sources other than from Fuel," and in the course of his remarks Mr. Donkin will make reference to water power, tidal water power, with reference to the Severn barrage scheme, and wave power. He will also refer to what has been done in utilising power from the sun, giving results of tests on the only reasonably large plant ever put down for this purpose, and describing shemes by various inventors for obtaining power from the latent heat of ice, from the thermal energy in the sea, natural steam in volcanic districts, and from the earth's heat, &c.

Appointments Vacant.

Shift charge engineer for Croydon Corporation. Assistant engineer and clerk of works for Graylingwell Mental Hospital, Chichester. Fitter-driver for Severalls Mental Hospital. Boiler-house charge engineer for Singapore Municipality. Chief assistant electrical engineer for Aylesbury Corporation. Meter mechanic and tester for Darwen Corporation. Station superintendent for Scarborough Corporation. Wireman for Cannock Urban District Council. Resident engineer at Kirkstall power station for Leeds Corporation. Mains engineer for Winchester Corporation. Assistant engineer £300-£400) for the Electric Development and Securities Trust, Ltd. (See our advertisement pages to-day.)

The Paris Motor-car Show.

One of the novelties of the Paris motor-car show, which was opened on October 4th, was the 8-cylinder Duesenberg car, an American product that is said to be capable of developing 265 h.p. It is fitted with electric indicating lamps on the dashboard, to tell the driver when and how the lubricating system and the battery are functioning. Another car has an electromagnetic gear-changing device for altering the back-axle ratio; it has an ordinary 3-speed gear box as well, so it has six gear ratios in all. The car is made by the Voisin Co.

The Battersea Power Station.

At a meeting of the Chelsea Borough Council held on October 2nd, the report of the special committee appointed by the Council in connection with the proposed Battersea power station was read. The report stated that on September 26th a deputation was received by the Minister of Health and the Minister of Transport from the borough councils concerned and from the authorities of Westminster Abbey. The deputation was informed by the Minister of Health that the Government had had under consideration the question of the Battersea power station since it came into office, and was unwilling to take any action likely to cause damage in any scheme. The Minister stated that up to he present no report had been received concerning the claim of the London Power Co. to have discovered a solution to the sulphur problem, but he assured the deputation that unless the Government was satisfied by its chemists that there would be no danger in this respect, the whole scheme would not be proceeded with. The Minister of Transport, who also spoke, said that quite rightly the local authorities affected were inquiring into the matter, but that it was his duty to do his utmost to secure an abundant supply of electricity at a cheap price. Concerning the proposed Fulham power station, the Minister added that the deputation could rest assured that consent to its erection would not be given unless the Government was satisfied that there would be no danger to health or to the buildings of London.

The 66-kV Grid System in London.

The B.I. Co. Laying 66-kV Cables in Regent's Park.

Edinburgh Electrical Society.

The syllabus of lectures for the 1929-1930 session contains the following:—October 23rd, "Electric Plant Repairs," Mr. J. Walker; November 6th, "Colour Lighting in Theatres, &c.," Mr. R. Gillespie Williams; November 20th, "Street Lighting," Mr. W. Millar; December 4th, "Static Condensers," Mr. H. Ferguson; December 18th, "Electric Traction," Mr. J. S. Ross; January 22nd, 1930, "Photo Electric Cells," Mr. H. C. Walker; January 24th, Whist Drive and Dance, Royal Arch Hall; February 5th, "Tele-Photography," Mr. W. P. Morris; February 19th, Apprentices' Night; March 12th, Annual General Meeting.

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New Flexible Cord Standard in U.S.A.

The Flexible Cord Group of the National Electrical Manufacturers' Association announces a new specification, to become effective on January 1st, 1930, which reads as follows:—

"All dry braids, both individual and overall, shall be braided of cotton, rayon, or silk in such a manner as to result in all adjacent individual parallel threads *actually touching each other*, and shall show no visible open spaces, when observed through a standard braid counter."

It is also stated that cords complying with the National Electrical Code can be identified by the following points:

(1) The parallel threads of all braids must touch when viewed under an ordinary single lens pocket magnifying glass.

(2) The rubber covering must be tough and stretchy, similar to that on a good grade of code wire, and of the required thickness.

(3) The copper conductors must either be tinned or protected by a fibrous covering to prevent corrosion.

(4) The minimum copper size for a standard cord is No. 18 a.w.g., usually made up of sixteen strands of No. 30 a.w.g.

(5) All underwriters' laboratories standard cords contain manufacturers' identifying marker threads as required by code and as given in Underwriters' List of Inspected Electric Appliances.

(6) Underwriters' labels further identify Underwriters' Laboratories standard cords.

The I.M.E.A. Report.

The Report to members of the Incorporated Municipal Electrical Association for September, 1929, contains a number of articles which should be of considerable interest to those engaged in the supply of electricity. Probably the most important is the one headed "The Grid Scheme," on p. 69, to which reference is made in our leading columns. By permission of Mr. A. C. Cramb, honorary secretary of the Association, we reproduce it here:—

"Several articles have recently appeared in the technical Press relative to the importance of the duties of electrical engineers in view of the 'change-over' consequent upon the advent of the various schemes prepared by the Central Electricity Board. It may now be opportune to point out that the importance of the duties of the engineer are not in any way diminished by the fact that his station will cease to generate electricity; but, on the other hand, they will rather increase. Distributive costs are much heavier than the cost of generation. In fact the major engineering problem in connection with the supply of electrical energy is the reduction of the charge which distribution incurs.

"Many authorities are under the impression that the engineer's duties will be considerably lightened. This is borne out by the fact that when making new appointments the salaries have been reduced, with the consequent result that the best men do not apply. Municipalities should seriously consider this matter, and if they are desirous of preventing engineers migrating to private companies, &c., which, in the end, is bound to have a deleterious effect upon the undertaking; then it is up to municipal electricity undertakings to offer them some inducement equal to that offered by private concerns.

"We are not advocating excessive salaries; but the mistake in cutting down salaries on the pretence that, under the new scheme, the work of the engineer is lessened, will we fear be found out too late."

As a commentary on the position we insert a paragraph from the *Manchester Guardian* of September 27th. Although the action of the Corporation in question was deplorable in offering a salary so disproportionate to responsibilities, it is highly satisfactory to note that no suitably qualified men have applied for the vacancy.

"The position of the Wolverhampton electrical engineer, advertised two months ago at £850 a year, rising to £1,050 in two years, has not yet attracted one single suitable applicant.

"As the Electricity Committee is strongly of the opinion that the salary offered is insufficient, it now recommends that the appointment should be readvertised at £1,000 a year.

"Forty applications have been received, but all were rejected on the ground that the applicants were without municipal experience, or were engineers only, or were over 45 years old."

Electrical Accidents in Switzerland.

A recently issued return shows that during last year 99 accidents in connection with h.p. electrical installations were recorded in Switzerland, as compared with 76 in 1927. The accidents caused the deaths of 30 persons and injuries to 73 others, these figures comparing with 29 and 51, respectively, in the preceding year. Thirteen of the killed and 44 of the injured were persons connected with the installations, the number of members of the general public killed and injured being 17 and 29, respectively. The Government Department entrusted with the inquiries into the cause of the accidents reports that while the majority of cases were due to momentary carelessness or forgetfulness, there were several instances in which the trouble arose through faulty equipment.

Institution Notes.

Institution of Electrical Engineers.

The programme of the ordinary meetings for the first half of the 1929-30 session is as follows:—

October 24th: Presidential Address, Col. Sir T. F. Purves, O.B.E.

November 7th: "The Analysis and the Measurement of the Noise Emitted by Machinery," Mr. B. A. G. Churcher and Mr. A. J. King.

November 21st: Joint meeting with the Institute of Fuel. Three short papers on "Low-temperature Carbonisation of Fuel, with special reference to its combination with the production of electricity."

November 28th: "Voltage Control of Large Alternators," Mr. H. W. Taylor.

December 5th: "Surges and Over-Voltage Phenomena on Transmission Lines due to Lighting and Switching Disturbances," Dr. H. Norinder.

December 19th: "The Heating of Buildings Electrically by Means of Thermal Storage," Lt.-Col. S. E. Monkhouse, R.E. (T.R.) and Mr. L. O. Grant.

"The Heat Pump, and Economical Method of Producing Low-grade Heat from Electricity," Mr. T. G. N. Haldane.

The annual dinner takes place on February 6th at the Hotel Cecil, Strand, W.C., and the twenty-first Kelvin Lecture will be delivered, on May 1st, by Mr. R. H. Fowler, F.R.S.

Institution of Railway Signal Engineers.

The following dates have been arranged for the meetings of the Institution:—

October 25th.—Annual dinner at the Criterion Restaurant.

November 13th.—"Specification, Installation and Maintenance of Power Signalling Installations." Mr. H. W. Moore.

December 11th.—"Some Notes on a.c. Rectifiers." Mr. F. A. Downes.

January 8th, 1930.—"Some Further Electrical Details of the Bow Road—Barking Signalling." Mr. H. H. Dyer.

February 12th.—Annual general meeting and presidential address.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. John Wayne Morgan, consulting engineer, has removed his office to 6, Church Road, Whitchurch, Cardiff (Telephone: Whitchurch 23).

The Times states that Colonel T. W. Pragnell has been appointed a director of the Westminster Electric Supply Corporation in the place of the late Sir H. O. Bax-Ironside.

Mr. T. H. Smith, B.Sc., has left St. Annes-on-Sea to take up the appointment of electrical engineering instructor at Jarrow Technical School. He has resided at St. Annes for seven years, and for five years has been at Lytham St. Annes electricity works, where the staff and workmen have presented him with a silver cigarette case as a parting gift. For three years Mr. Smith taught electrical engineering at Lytham St. Annes Technical School.

Mr. A. S. Clarke recently resigned from the position of assistant sales manager to the North Metropolitan Electric Power Supply Co. to take up an appointment in Mandalay with the Burma Electric Supply Co., Ltd. He sailed for Burma on October 4th by the s.s. *Yoma;* his address will be 78th Street, Mandalay.

It is reported that Mr. Norman Birkett, K.C., has offered to represent, free of all fees, the opposition in the event of a public inquiry being held into the proposal to erect overhead electricity wires in the Keswick portion of the Lake District.

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Cheltenham Corporation Electricity Committee has appointed Miss D. Blaker, of Portsmouth, as electrical cooker demonstrator.

Mr. Alan Kirk, A.M.I.E.E., has been released from his engagement with Messrs. Troughton & Young, Ltd., in order that he may accept the post of electrical engineer to the headquarters staff of Northcliffe Newspapers, Ltd., Carmelite House, E.C.4.

Blackburn Electricity Sub-Committee has considered applications for the post of electrical engineer and manager in succession to Mr. P. P. Wheelwright. The 40 applicants were reduced to 8, and the sub-committee will visit the towns in which these men are engaged.

Mr. G. V. Stanley, who has since July, 1928, been acting tramway manager at Croydon, has been appointed permanently as tramway manager at a salary of £600 per annum.

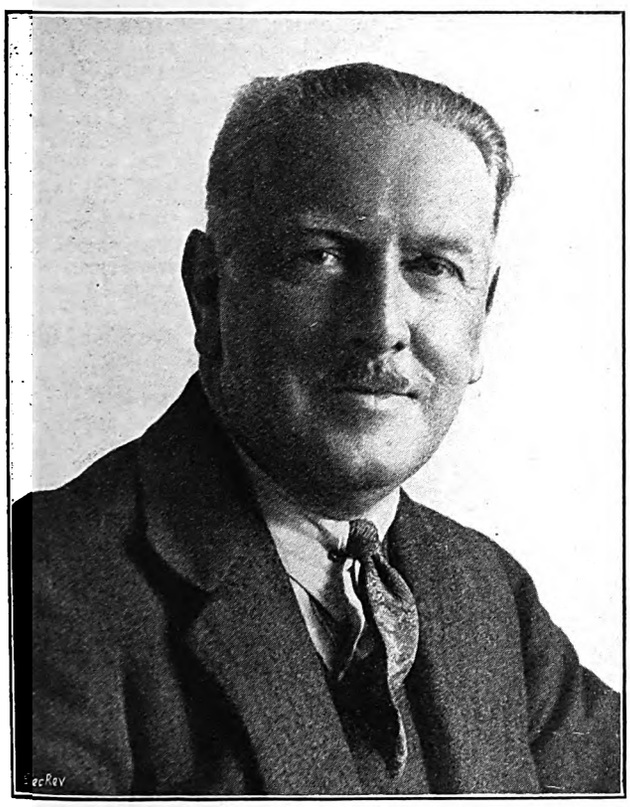
The Council of the Mining Academy of Freiburg, Saxony, Germany, has awarded the title of Honorary Engineer to Herr Paul Wolf in recognition of his work in connection with electric safety lamps for mines.

Upon his being appointed electrical engineer at Dumfries, the staff and employés of the Worcester Electricity Department have presented Mr. A. E. Roots, chief assistant, with an oak table.

The Worksop Urban District Council has decided to increase the salary of the chief engineer and manager of the electricity department, Mr. M. S. Mason, by £50 per annum, with three further annual increments of £50.

The meetings of the Institution of Electrical Engineers for the 1929-30 session commence next week, and in accordance with past practice we propose to publish portraits and brief biographical notes of the chairmen of the various Centres.

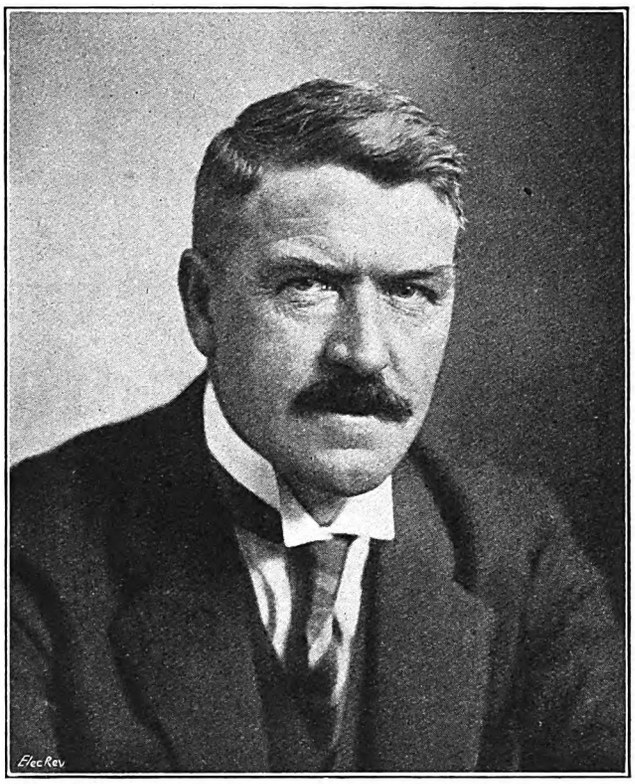
The first chairman's address will be delivered next Monday by Mr. S. B. Haslam, at the Western Centre. Mr. Haslam was educated at Shrewsbury School and Faraday House; his predecessor in the chair, Mr. W. J. Bache, is also an Old Faradian. Mr. Haslam commenced engineering as a pupil in the Taff Vale Railway Co., Cardiff, and subsequently went to the Siemens works at Woolwich. In 1902 he joined the staff of Messrs. Harland Bowden & Co., Manchester, and left this company in 1906 to commence his partnership with Mr. Theodore Stretton. This combination still exists in the form of Haslam & Stretton, Ltd. During the war he served in Egypt and Salonika with the Rifle Brigade and Royal Engineers, reaching the rank of major. Mrs. Haslam is the daughter of a past-president of the Institution of Mechanical Engineers (Mr. T. Hurry Riches, J.P.). In addition to his membership of the I.E.E., Mr. Haslam is a member of the Institution of Mechanical Engineers, the Iron and Steel Institute, the Association of Mining Electrical Engineers, and the South Wales Institute of Engineers. He has read papers before some of these institutions, and was recently awarded the gold medal of the Association of Mining Electrical Engineers for the best paper presented to the Association during the 1928-29 session.



Western Mail] [*Cardiff.*

Mr. S. B. Haslam, M.I.E.E., M.I.Mech.E.,
Chairman of the Western Centre of the I.E.E.

Mr. G. R. J. Parkinson, whose portrait accompanies this note, is to deliver his address as chairman of the South Midland Centre on Wednesday next. Mr. Parkinson proceeded to Faraday House upon leaving Dulwich College. His early training was received at the works of Messrs. John Fowler, Leeds, and with the London Electric Supply Corporation, Deptford. For five years he was engineer-in-charge at the Portsmouth undertaking, and subsequently he went to the South London Electric Supply Corporation, Lambeth, as station superintendent. He joined his present company, the Midland Electric Corporation for Power Distribution, Ltd., 37 years ago. He commenced as a resident engineer, and after ten years' service became chief engineer. He held that position for 12 years, and was then appointed to his present post, that of manager and engineer. Mr. Parkinson is chairman of the Technical Operating Committee of the West Midlands Joint Electricity Authority, and is the present chairman of the No. 5 District Joint Industrial Council for the Electricity Supply Industry.



Elliott & Fry] [*London.*

Mr. G. R. J. Parkinson, M.I.E.E.,
Chairman of the South Midland Centre of the I.E.E.

Colonel T. W. Pragnell has been appointed a director of the Westminster Electric Supply Corporation in the place of the late Sir H. O. Bax-Ironside.

We regret to learn that Sir John Snell is on the sick list again. A Glasgow paper, referring to the matter, says: "He was compelled to prolong his annual holiday for a couple of months, but in spite of the rest he has been ordered again to give up work for a period. He had hoped to deliver the last of the regional schemes to the Central Electricity Board before the end of the year, but his illness, I gather, is likely to interfere with this programme." We desire to express our sincere sympathy with Sir John in his continued illness, and to assure him of the hopes of the profession and industry for his early recovery.

Mr. W. Dundas, resident engineer at the Barton power station, Manchester, has resigned, and the Electricity Committee has adopted a resolution recording its appreciation of his services to the department. His successor is Mr. S. A. Russell, A.M.I.E.E.

The *Yorkshire Post* reports that out of 59 applicants for the position of traffic superinendent of the Blackpool Corporation tramways and motor-'buses, Mr. W. M. Campbell, motor-'bus superintendent, Edinburgh City, was on Monday selected. The salary is £500. Mr. Campbell has had 26 years' service at Edinburgh.

Eleven employés of the Derby Electricity Department were presented with gifts from the staff and workmen of the Department when they retired on pension last week. The borough electrical engineer, Mr. G. H. Lake, described them as "stalwarts of the undertaking." Their combined period of service had been 225 years. The average age of the men was 71 years and the average period of service 21 years. Their minimum retiring pension is 25s. per week.

The marriage took place at Gloucester, on October 7th, of Mr. H. A. C. Ridsdale, B.Sc., of the electrical staff of the

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Synthetic Ammonia & Nitrates, Ltd., and Miss Marie G. Wyman, daughter of Mr. C. F. Wyman, electrical engineer, Gloucester.

Mr. Joseph Robinson, who was married, on October 2nd, to Miss Marion Fitton, was presented by the staff and employés at the Bury, Lancs., Corporation electricity works with a Jacobean oak timepiece.

Obituary.—Mr. H. Collinson.—The funeral took place on October 1st of the late Mr. Herbert Collinson, partner in the firm of Collinson Bros., electrical contractors, Bradford. Mr. Collinson, who was only 47 years of age, received injuries, which proved fatal, owing to the slipping of a ladder whilst he was examining work on the new electric lighting installation which his firm had in hand at the Clayton Parish Church. Mr. Collinson was a member of one of the best-known electrical contracting firms in the Bradford district, and a lecturer in electrical engineering at the Bradford Technical College. He leaves a widow and four children. The funeral was attended by a large gathering of representatives of the Bradford and other Yorkshire branches of the Electrical Contractors' Association and other electrical bodies.

Mrs. J. C. Whitmoyer.—We learn with great regret that Mrs. Whitmoyer, wife of Mr. J. C. Whitmoyer, M.I.E.E., contracts manager of the Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester, died suddenly on Tuesday, the 1st inst. We are sure that his many friends in the industry will desire to express their deep sympathy with him.

Dr. R. V. Hansford.—We regret to record the death, as a result of an accident on October 5th, of Mr. Richard Vernon Hansford, D.Sc., who, for the past 19 years had been in the Chief Engineer's Department of the General Post Office. In recent years Dr. Hansford was concerned with the development of wireless telegraphy and telephony and the success of the transatlantic telephone service was due to a great extent to his work. He was 41 years of age. The funeral took place at Bandon Hill Cemetery, near Waddon, Surrey, on Wednesday last.

Mr. W. Bannister.—We have to announce, with regret, that Mr. William Bannister, J.P., who was an original director of the Chloride Electrical Storage Co., Ltd., of which company he had been chairman for the past 27 years, died at his home at Croydon on October 1st, at the advanced age of 82 years.

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Universal Consulting Patent, Ltd.—Private company. Registered October 1st. Capital, £200 in £1 shares. Objects: To acquire patents, rights, secret processes, licences, protections, and concessions; to manufacture machinery, and to carry on the business of mechanical, consulting, electrical and motor engineers, manufacturers of electric lamps and apparatus, motor-cars and accessories, &c. The first directors are:—J. N. Waring, 22, Grangecliffe Gardens, South Norwood, S.E.25; D. Krestin, 17, Culverley Road, Catford, S.E.6, engineer; T. E. Beaumont, address not stated; A. Swale, address not stated. Registered office: Aldwych House, Aldwych, W.C.2.

Philips Lamps (Ireland), Ltd.—Private company. Registered in Dublin on September 27th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of electricians, manufacturers of, agents for, and dealers in all kinds of electric lamps, including gasfilled lamps, &c. The subscribers are:—A. De Jong, 148, King's Avenue, London, merchant; D. C. F. Van Eendenburg, "Hindounid," Gloucester Road, Kingston-on-Thames. The first directors are not named.

Safac Accumulator Co., Ltd.—Private company. Registered October 2nd. Capital, £500 in £1 shares. Objects:—To carry on the business of manufacturers of and dealers in accumulators, &c. The directors are:—J. Carlier, 221, Avenue de Tervueren, Brussels, Belgium; G. Gall, 9, Severn Avenue, Hare Park, Romford; G. Judd, 11, Earl Cottages, Earl Road, Bermondsey, S.E.; E. Lever, 12, Highbury New Park, N.5. Solicitors: W. R. Bennett & Co., 74, Great Russell Street, W.C.1.

Electric Central Heating and Ventilating Co., Ltd.—Private company. Registered in Edinburgh on September 28th. Capital, £20,000 in £1 shares. Objects:—To carry on the business of lighting, ventilating, heating, electrical and mechanical engineers, &c. The directors are:—G. B. Burnside, 104, Buchwood Drive, Glasgow, mechanical engineer; W. B. Hutchinson, 4, Brownside Road, Cambuslang, electrical engineer. Registered office: 157, West George Street, Glasgow.

Emkabe Radio Co., Ltd.—Private company. Registered October 3rd. Capital, £100 in £1 shares. Objects:—To carry on the business of manufacturers of and dealers in wireless and electrical goods, &c. The directors are:—A. Fuchs and I. Falkenflieg, 19, Argyle Square, W.C. Secretary: A. Fuchs. Registered office: 47, Farringdon Road, E.C.1.

Hudson Radio, Ltd.—Private company. Registered October 4th. Capital, £100 in £1 shares. Objects: To carry on the business of engineers, advisers, experts and consultants, in connection with wireless, &c. The subscribers (each with one share) are: R. H. Currell, 79, Scott's Road, Leyton, E.10, clerk; C. H. Blazier, 11, Downhurst Avenue, Mill Hill, N.W., clerk. The first directors are to be appointed by the company or by the subscribers. Secretary: M. Marks, 65/6, Basinghall Street, E.C.

Automatic Light Control, Ltd.—Private company. Registered September 30th. Capital, £10,000 in £1 shares. Objects: To carry on the business of electrical engineers and contractors, mechanical engineers, manufacturers and repairers of and dealers in machinery, photographic, scientific, electrical, magnetic, galvanic, television, signalling and kinematography apparatus, &c. The subscribers (each with one share) are: F. W. W. Highfield, Ingleside, Warwick Road, Kenilworth, electrical engineer; H. Megainey, 17, Shaftesbury Road, Coventry, secretary. The first directors are not named. Solicitors: R. A. Rotherham & Co., 38, Bailey Lane, Coventry.

Electrotone Talking Pictures, Ltd.—Private company. Registered October 4th. Capital, £100 in 1s. shares. Objects: To carry on the business of manufacturers of and dealers in cinematograph films and apparatus of all kinds, to produce, exhibit or deal in films, either talking or silent, and in all apparatus or mechanism for manufacturing or exhibiting such films, and any device, mechanical, electrical or otherwise for synchronising films and vocal or other sounds, &c. The directors are: T. W. Meldrum, 1, Albemarle Street, W.1; G. L. Padley, address not stated. Solicitors: Boyce, Evans and Sheppard, 14, Stratford Place, W.

L. Cole & Sons, Ltd.—Private company. Registered October 4th. Capital, £500 in £1 shares. Objects: To carry on the business of engineers, advisers, experts, consultants, and contractors, &c., in connection with wireless telephony or telegraphy, &c. The subscribers (each with one share) are: R. H. Currell, 79, Scott's Road, Leyton, E.10, accountant's clerk; C. H. Blazier, 11, Downhurst Avenue, Mill Hill, N.W., accountant's clerk. The first directors are to be appointed by the company or by the subscribers. Secretary: M. Marks.

Radio Recordion, Ltd.—Private company. Registered September 30th. Capital £500 in £1 shares. Objects: To carry on the business of manufacturers, producers, importers, and exporters of, agents for and dealers in gramophones and phonographs either separate or combined with cinematograph, wireless and/or television apparatus, &c. The provisional directors are: H. B. Pritchard, 19, Kingsland, Newcastle-on-Tyne; W. Pritchard, Melkridge House, Haltwhistle, Northumberland; Dr. R. W. Simpson, 74, Jesmond Road, Newcastle-on-Tyne.

Official Returns of Electrical Companies.

Embleton & Barker, Ltd.—Capital, £1,000 in £1 shares. Return dated April 2nd, 1929. All shares taken up. £500 paid. £500 considered as paid. Mortgages and charges, nil.

Premier Wholesale Electric Co. (Stockport), Ltd.—Satisfaction in full on September 2nd, 1929, of mortgage dated September 29th, 1923, securing £330.

Tisbury Electric Supply Co., Ltd.—Capital, £6,000 in £1 shares. Return dated May 23rd, 1929. All shares taken up. £6,000 paid. Mortgages and charges, nil.

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Western Electric Co., Ltd.—Capital, £20,000 in £1 shares. Return of allotments, made up to April 16th, 1929, shows all shares allotted, payable in cash, and fully called up. Mortgages and charges, nil.

Northleach Electric Supply Co., Ltd.—Capital, £3,000 in £1 shares. Return dated May 14th, 1929. 1,750 shares taken up. £1,800 paid (including £50 paid on 100 forfeited shares). Mortgages and charges, nil.

Oxford Electric Co., Ltd.—Capital, £350,000 in 150,000 6 per cent. preference and 200,000 ordinary shares of £1 each. Return dated May 3rd, 1929. All shares taken up. £316,000 paid on 150,000 preference and 166,000 ordinary shares. £34,000 considered as paid on 34,000 ordinary shares. Mortgages and charges: £110,000.

Dudley, Stourbridge & District Electric Traction Co,, Ltd. Capital, £200,000 in 20,000 preference and 20,000 ordinary shares of £5 each. Return dated May 14th, 1929. All shares taken up. £200,000 paid. Mortgages and charges: £103,140.

Wells, Rayner & Co. (1929), Ltd.—Capital, £2,000 in £1 shares. Return dated December 31st, 1928 (filed September 6th, 1929). 558 shares taken up. £558 paid. Mortgages and charges, nil.

Western Counties Electrical & Engineering Co., Ltd.—Two mortgages, dated September 21st and 23rd, 1929, to secure £3,000 and £350, respectively, charged on 18, Princes Street, Yeovil. Holders: Frome Selwood Permanent Building Society and A. M. G. Daniel, Frome.

C. J. Thursfield & Co., Ltd.—W. F. Alldritt and C. E. Ward, Sun Buildings, Bennetts Hill, Birmingham, were appointed receivers and managers, in substitution for the late W. E. Alldritt, on September 13th, 1929, under powers contained in debentures dated January 8th, May 13th, and October 10th, 1927.

Harry Morser & Co. (Wireless), Ltd.—H. E. F. Connolly, 10, Nutley Lane, Reigate, ceased to act as receiver or manager on September 25th, 1929.

City Notes.

Stock Exchange Notices.

Application has been made to allow the following to be officially quoted:—

W. & T. Avery, Ltd.—676,449 ordinary shares of £1 each, fully paid, Nos. 1 to 676,449; 26,846 5 per cent. "A" cumulative preference shares of £5 each fully paid, Nos. 1 to 26,846; and 147,128 5½ per cent. "B". cumulative preference shares of £1 each fully paid, Nos. 1 to 147,128.

Chloride Electrical Storage Co., Ltd.—395,550 "A" ordinary shares of £1 each fully paid, Nos. 62,001 to 457,550; 111,655 "B" ordinary shares of £1 each fully paid, Nos. 457,551 to 569,205; and 62,000 6 per cent. cumulative preference shares of £1 each fully paid, Nos. 1 to 62,000.

Dealings in the following have been allowed by the Committee under Rule 159:—

Underground Electric Railways Co. of London, Ltd.—4,710 ordinary shares of £1 each, fully paid, Nos. 7,230,053 to 7,234,762.

Folkestone Electricity Supply Co., Ltd.

We briefly reported in our last issue that the acquisition of the company's ordinary capital by the County of London Electric Supply Co., Ltd., would be effected by an exchange of shares. The basis of the exchange will be five ordinary "County" shares for each four Folkestone shares. The County Company stipulates that the offer must be accepted by holders of 80 per cent. of the Folkestone Company's shares (or such less percentage as it cares to accept). The shareholders of the County Company have been asked to ratify the agreement on or before October 14th.

Vera Cruz Electric Light, Power and Traction, Ltd.

The report for the year ended December 31st, 1928, records a net profit in Mexico of £30,085. After deducting all expenses and service of debentures, and a debit balance of £17,693 brought forward from 1927, there is a debit balance of £7,422. The failure of the Vera Cruz Municipality to meet its bills for public services is seriously affecting the profits.

Stothert & Pitt, Ltd.

A dividend of 10 per cent. is recommended, against 6 per cent. last year.

Oriental Telephone and Electric Co., Ltd.

An interim dividend of 4 per cent., free of tax, has been declared on the ordinary shares.

North Metropolitan Electric Power Supply Co.

An interim dividend of 4 per cent. has again been declared on the ordinary shares, payable on November 15th.

Callender's Cable & Construction Co., Ltd.

The interim dividend on the ordinary shares is again 5 per cent.

Stocks and Shares.

Tuesday Evening.

The effects of the high Bank Rate and the aftermath of the Hatry group collapse are still potent factors in Stock Exchange affairs. Added to this, there was at the end of last week a violent shake-out in the prices of the American utility shares which have been soaring, apparently without limit, and whose upward flight became abruptly checked by a wave of selling that caused severe falls. Some prices have gone back as much as 50 points from the best recently touched. One seller tends to make many others, and, with the New York market thrown into a thoroughly nervous condition, the repercussion on this side made an added element of disturbance at a time when our own markets were far from ready to stand any further shocks after the two mentioned in the opening lines above. The violence of the fall had the usual effect of bringing in both bears and bargain hunters, with the result that the lowest prices did not prevail for long, but were succeeded by a fairly substantial recovery.

Money Matters.

The Bank Rate of 6½ per cent. is not expected to be exceeded, in view of the satisfactory way in which foreign exchanges have shown a disposition to become more normal, the outstanding exception being that of France. According to arrangements at present in force, the settlement in connection with what are called the Hatry shares is postponed, from October 24th, to a date not yet fixed. This is due to the difficulties encountered in the unravelling of the many knotty points at issue. Until the settlement in these stocks and shares is out of the way, there is bound to be a certain amount of nervousness in regard to the length to which ramifications of the collapse may have extended. New issues find favour, however, where they offer good security and a reasonable rate of return. A line of new 6 per cent. preference shares in the Shropshire, Worcestershire & Staffordshire Electric Power Company recently came to market, and buyers readily took them at a guinea and thereabouts.

Folkestone Electric Acquisition.

Mention was made here last week of the acquisition by the County of London Company of the Folkestone Electric Company. Official details show that the offer of the County Company represents the exchange of five of its shares for four of the Folkestone Electrics, this basis guaranteeing to the Folkestone proprietors the same amount of dividend as they have been receiving from their own undertaking. The financial effect was to make Folkestones worth something like 70s., taking County of London at 57s., and the prices became adjusted, Folkestones rising to the former figure, and County of London going back to 54s. 6d. Some of the Folkestone shareholders elected to take their profit before the amalgamation was formally completed, with the result that the prices gave way to 66s. 3d., which is ex dividend. The announcement led to speculation as to what is likely to be the next company that will attract the attention of the County of London, and a rise in Isle of Thanet shares to 39s. is an indication of what is hoped may materialise in the future.

It may not do much harm to mention now that the offer of the County of London Company was not the first that the Folkestone Electric had received. Some time ago, the Folkestone board was approached by another group with a view to negotiating for a purchase of the Folkestone undertaking, but the terms offered at that time were not considered sufficiently attractive, and shareholders in the Folkestone Company owe their directors appreciation for awaiting that better offer which subsequent events have shown the board to be justified in expecting.

Electricity Supply.

Bournemouth & Poole are again 1/16 lower at 63/3. Midland Counties, Scottish Power, and Yorkshire Electrics show small declines. Lancashires can be bought for less than the middle price of 28s. On the other hand, Egham & Staines rose 1s. to 38s., and Northants 6d. to 48s. 3d. Newcastle and District ordinary are dull at 28s. 9d., the new shares being 27s. 9d. British Light & Power continue to be neglected. The price is 15s. 6d. Atlas, at 26s. 9d., have shed 3d. The prevailing tendency in this department is dullish. Perak Hydro-Electric ordinary shares drooped to 15s.

Cables and Wireless Stocks Recover.

The flatness which for some time past has characterised the stocks of the Cables & Wireless Company gave way to a more cheerful disposition, owing to speculative purchases of the company's "B" ordinary stock. It will be remembered that the price fell from 100, touched last July, to 55 some ten days ago. Probably it was premature to pay anything like three figures for the stock, but at 55 speculation can reasonably hope for an advance in the price on prospects. The position is that though the "A" ordinary stock is not likely to get the full 7½ per cent. to which it is entitled during the first year of working, the proper amount should be earned in the second year, and this would bring into nearer vision the chance of the "B" stock receiving a distribution within the course of the next three or four years. This "B" stock represents the equity of the Cables & Wireless business, and it is with this

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that speculation is chiefly concerned. Meanwhile, the 7½ per cent. "A" ordinary stock is a sound speculative investment at anything like the present figure of 82½. Purchasers should be content to look for no more than 5 per cent. out of the first year's working. After that, the dividend, as already mentioned, should improve steadily.

Home Rails.

The Home Railway market has made an effort to participate in the general improvement which set in at the early part of this week. Several of the steam companies' stocks advanced, and the Undergrounds were able to shake off their recent depression. The strike of a few hundred London General Omnibus men was quickly settled, and the Underground Electric Railways issues, which had given way, recovered to a slight extent, the £1 shares to 22s. 6d., the income bonds to 106. Metropolitan consolidated more than regained its previous loss, and spurted to 61. Districts are 72½, or 30s. higher than the prices of Central London assented ordinary, preferred ordinary and deferred ordinary stocks. Of the company's unassented issues, the prices are 71, 59½, and 77½, respectively.

American Utilities.

Amongst the more familiar stocks and shares of the American utilities group, the losses have been mild, as compared with the slump sustained by certain of the kerb market favourites. A drop of 7 points (less 60 cents dividend deduction) has left the price of Montreal Light & Power at 167½, which still means a net gain of 9 points within the past fortnight. Shawinigan Water is down no more than 1½, at 104½. Power Corporation of Canada fell 6 to 120½. Pennsylvania Light and Power rallied to 96, after having been 93½. Consolidated Gas and Electric, of Baltimore, has gone back to 135½. Hydro-Electrics, pursuing their zigzag career, came down from 83½, at which they stood ten days ago, to 70 last Thursday. New York bulls took them in hand, and rallied the price to 74½. International Holdings are better on the week, at 10½. Brazilian Tractions show no net change at 72, but the price has been considerably lower in the week's interval; the 6 per cent. preference maintain their advance to 240.

Tramway Shares.

Para Electric Railways & Lighting ordinary shares have gone back to 4s., and both classes of preference weakened to the common price of 13s. 9d. Anglo-Argentine Tramways preferences, first and second alike, are lower at 3 1/16 on sales probably made to meet obligations incurred in other directions. La Plata Trams are nominally 2s. 6d. middle. The last transaction recorded in them was at 2s. 0¾d., three weeks ago, the 6 per cent. preference changing hands at 20s. 9d. about the same time. Trifling improvements took place in certain of the London companies' shares. London & Suburban preference hardened a few pence, to half a guinea, and the ordinary are slightly firmer at 2s. 6d. Potteries' preference fell back to 7s. 6d. Llandudno & Colwyn Bay Electric Railway ordinary are something of a curiosity, the official quotation being "0 to 2s." No shares are recorded as having changed hands since June, 1927, when business was marked at 1s. 1d. They are £1 shares, fully-paid, and last received a dividend in April, 1923.

Manufacturing and Equipment.

Reactions, mostly extremely modest, have occurred in some of the manufacturing shares that recently enjoyed handsome rises. Amongst others which are easier may be mentioned Henleys, Callenders, Enfields and British Insulated. Brush ordinary keeps heavy at 130, British Aluminium weakened to 2½. Associated Electrical Industries to 38s. 9d.; General Electrics retained their price, at 52s. 6d. Crompton Parkinson ordinary, after their sharp fall last week recovered 1s. and now stand at a guinea. The new shares issued at 10s, fell to 9s. 6d. and rallied to 10s. 6d. Ever-Ready shares, at 19s., are a shade better than they have been; Ever-Ready Trusts are quoted somewhat nominally at 15s. Until the Trust has published the result of its first year's working, no particular change is to be expected in the condition of the market. Of the iron and steel shares, Babcock and Wilcox receded 1/16 to 63s. 9d., the interim dividend of 7 per cent, actual and tax-free, having no influence upon the price. Vickers went back to 8s. 3d. before hardening to 8s. 7½d. The rubber share market, after being heavy and dispirited, took a turn for the better, upon a small rise in the price of the raw material.

Telephones and Telegraphs.

Marconi Marines have made further downward progress, being again 2s. 6d. lower, at 52s. 6d.; Canadian Marconis are 31s. Oriental Telephones have dropped back to 58s. 9d. Venezuela Telephones changed hands a week ago at 26s. 6d. Great Northern Telegraphs are 10s. down at 30½. The shares of the Holding Company are being dealt in on the basis of 8½. Western Union Telegraph stock marked at 215 on October 2nd. A fall of 2 in Anglo-American Telegraph preferred, to 101, is due to monetary conditions. Small losses have lowered American Telephone and Telegraph to 300, International Telephones to 125. The extending use of the dialling system fails to affect the price of Automatic Telephones, which keeps about 37s. 6d. Business in these, as in International Automatic Telephones, is very quiet.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Approx. Dividend. 1927.	1928.	Price Oct. 8 1929.	Rise or fall	Yield p.c.
	£					
Bournemouth and Poole	1	15	15	63/3	—1/3	4 15 0
Brompton Ordinary	1	8½	8½	26/-	—	5 7 8
Charing Cross Ordinary ...	1	8½	8½	26/6	—	5 5 8
do. do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8¾	8¾	25/-	—	5 12 0
City of London	1	10	10	32/-	—	4 7 6
do. do. 6% Pref....	1	6	6	22/-	—1/-	5 9 1
Clyde Valley	1	8	8	36/3	—	... ...
County of London	1	7	10	54/6	—3/-	3 13 6
do. do. 6% Pref....	1	6	6	22/6	—	5 6 8
Edmundson's 7% Pref. ...	1	7	7	24/-	—	5 16 8
Elec. Supply Corporation ...	1	11	11	52/-	—	4 4 8
Kensington Ordinary ...	1	8	8	26/-	—	5 7 8
Lancs. Light and Power ...	1	7½	7½	28/-	—	5 7 2
London Electric	1	8½	9	27/6	—	5 1 10
Metropolitan	1	9	9	46/3	—	3 17 3
do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6½	6½	33/6	—1/-	3 17 7
Mid. Elec. Power	1	15	8	35/-	—⅛	4 11 5
Newcastle-on-Tyne Ordinary	1	6	6	26/3xd	—	4 11 5
do. 7% Pref. ...	1	7	7	25/-	—6d.	5 12 0
Notting Hill 6% Pref. ...	10	6	6	11	—	5 9 1
North Met. Elec. 6% Pref. ...	1	6	6	21/6	—1/-	5 11 8
St. James' and Pall Mall ...	1	8	8	26/6	—	5 5 8
Scottish Power	1	8	8	31/-	—6d.	5 3 3
South London	1	8½	8½	26/6	—	5 5 8
Urban Ordinary	1	7	7	38/3	—	3 13 6
Westminster Ordinary ...	1	8⅝	8⅝	25/6	—	5 9 10
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	23/9	—	6 6 4
Yorkshire Elec.	1	8	8	36/-	—6d.	4 9 0

Home Rails.

Central London Ord. Assented ...	Stock	4	4	71	—	5 12 8
Metropolitan	"	8	8½	61	+2½	5 17 8
do. District	"	4	5	72½	+1	6 19 10
Underground Electric	£1	5	7	22/6	+6d.	6 4 5
do. do. Income ...	Bonds	6	6	106	+1	5 13 2

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	101	—2	5 18 10
do. Def.	"	1½	1½	24½	—	6 4 5
Automatic Telephone	1	10	12½	37/6	—	6 13 4
Cables & Wireless 5½ Pref.	Stock	—	—	92½	—	5 19 0
do. A 7½ Ord.	"	—	—	82½	—	... ...
do. B Ord.	"	—	—	58½	+1	... ...
Globe Tel. and T. Ord.	10	10	10	25	—	*3 18 6
do. do. Pref.	10	6	6	10⅝	—	5 9 1
Great Northern Tel.	10	20	17½	80½	—½	5 14 9
Indo-European	25	10	10	47½	—	*5 5 8
Marconi-Marine	1	12½	15	28	—⅛	5 14 2
Oriental Telephone Ord	1	12	12	21⅛	—⅛	... ...

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	8⅛	—⅛	8 19 6
do. do. 2nd Pref. ...	5	6	6	8⅛	—⅛	9 16 0
do. do. 5% Deb. ...	Stock	5	5	75	—	6 13 4
British Electric Traction Def. Ord.	"	5	5	160	—	... ...
do. do. Pref. Ord.	"	8	8	122½	+1	6 11 9
Brazil Traction	100	7	8	72	—	2 15 7
Brit. Columbia Elec. Rly. Pcs. ...	Stock	5	5	56½	—	5 15 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	10/6	+6d.	... ...
London United Tram Deb. ...	Stock	4	4	51½	—	7 15 4
Mexico Trams, 5% Bonds	—	5	5	75½	—	6 12 5
Mexican Light Common	100	Nil	Nil	117½	—9	... ...
do. 7% Pref.	100	7	7	80½	—	8 8 8
do. 1st Bonds	—	5	5	18	—	6 12 5
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...

Manufacturing Companies.

Assoc. Elec. Ord.	1	6	—	38/9	—⅛	8 2 0
Babcock & Wilcox	1	18	15	63/9	—⅛	*4 14 2
British Aluminium Ord.	1	10	10	50/-	—9d.	*4 0 0
British Elec. Transformer Pref. ...	1	7	7	18/-	—	... ...
British Insulated Ord.	1	15	15	4	—⅛	8 15 0
Brush Ord.	Stock	10	10	130	—	7 13 10
Callenders	1	15	15	3⅛	—⅛	8 16 2
do. 6½% Pref.	1	6½	6½	1¾	—	5 4 0
Crompton Parkinson Ord.	5/-	—	80	21/-	+1/-	7 2 0
do. 8% Pref.	1	8	8	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	7 1 2
do. 5% Deb.	Stock	5	5	84½	—	5 18 4
Electric Construction	1	7½	5½	15/-	—	7 6 8
Enfield Cable Ord.	1	20	20	5	—⅛	4 0 0
English Electric	1	Nil	Nil	8/8	—	... ...
do. do. Pref.	1	8	Nil	8/9	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
do. Ord.	1	10	10	2⅝	—	3 16 2
Henley...	1	25	30	6½	—⅛	4 12 4
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	Nil	Nil	12/6	—	... ...
Johnson & Phillips	1	10	—	2	—	5 0 0
Siemens Ord.	1	7½	7½	28/9	—	5 4 4
Telegraph Construction	12	10	16	23	—	5 4 2

* Dividends paid free of Income Tax.

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Electrical Imports of New Zealand.

The Figures for 1927 and 1928 Compared.

THE following table shows the values of electrical and allied goods imported into New Zealand in 1928, according to the recently-issued official trade returns. The figures for 1927 have been given for purposes of comparison, and notes of increases or decreases added :—

	1927. Thous.	1928. Thous.	Inc. or dec. Thous.
Electric batteries and cells—	£	£	£
Total	151	162	+ 11
From United Kingdom	37	44	+ 7
,, United States	93	65	− 28
,, Canada	19	48	+ 29
,, Denmark	1	1	—
Generators, motors and transformers—			
Total	518	486	− 32
From United Kingdom	320	327	+ 7
,, United States	89	94	+ 5
,, Sweden	31	23	− 8
,, Canada	17	12	− 5
,, Belgium	2	1	− 1
,, Germany	40	12	− 28
Insulated cable and wire—			
Total	520	375	− 145
From United Kingdom	485	346	− 139
,, United States	7	4	− 3
,, Australia	3	1	− 2
,, Canada	10	5	− 5
Electric lamps (incandescent filament)—			
Total	154	176	+ 22
From United Kingdom	100	117	+ 17
,, Netherlands	29	35	+ 6
,, United States	17	17	—
,, Austria	2	3	+ 1
Other electric lamps—			
Total	27	22	− 5
From United Kingdom	4	4	—
,, United States	17	12	− 5
Carbons in blocks, &c.—			
Total	23	19	− 4
From United Kingdom	14	13	− 1
,, United States	6	5	− 1
,, Australia	1	1	—
Insulators—			
Total	*	20	—
From United Kingdom	*	15	—
,, United States	*	3	—
Wireless sets in cabinets—			
Total	*	34	—
From United Kingdom	*	3	—
,, Canada	*	3	—
,, Australia	*	3	—
,, United States	*	25	—
Telegraph and telephone material—			
Total	380	304	− 76
From United Kingdom	94	63	− 31
,, United States	178	73	− 105
,, Belgium	72	138	+ 66
,, Netherlands	12	15	+ 3
Other electrical material—			
Total	648	504	− 144
From United Kingdom	354	294	− 60
,, United States	125	87	− 38
,, Australia	22	20	− 2
,, Canada	82	74	− 8
,, Switzerland	11	10	− 1
,, Sweden	40	3	− 37
Electricity meters—			
Total	46	50	+ 4
From United Kingdom	43	38	− 5
,, United States	1	1	—
Recording and testing instruments and meters—			
Total	82	77	− 5
From United Kingdom	50	47	− 3
,, United States	25	22	− 3
,, Germany	3	3	—
Turbines, water—			
Total (All from United Kingdom)	18	24	+ 6

* Not specified.

Indian Electrical Notes.

By An Indian Correspondent.

The Tata Companies.

CONSIDERABLE interest is attached to the recent announcement that an agreement has been concluded between Messrs. Tata & Sons, Ltd., of Bombay, and an American syndicate whereby the firm of Tata will share with the American syndicate the agency of the Tata Hydro-Electric Power Supply Co., Ltd., the Andhra Valley Power Supply Co., Ltd., and the Tata Power Co., Ltd. The American Syndicate will have a half share in the agency, which will be converted into a private limited company. The arrangement will not affect the present proprietary rights of the three joint stock companies, but is merely meant to enlist the co-operation of experts in hydro-electric works in America. The Tata water power undertakings, intended to supply the city of Bombay and its surroundings, are the largest hydro-electric works in India. The total present demand for mills, tramways and railways, &c., in Bombay is about two-thirds of the total capacity of the triple works, which is 285,000 h.p., made up as follows:—Tata Hydro-Electric Supply Co., 70,000 h.p.; Andhra Valley Co., 60,000 h.p.; and the Tata Power Co., 155,000 h.p. A further potential source, called the Konya River project, has recently been investigated, which, when carried out, will make available a further 80,000 h.p. The energy of this triple installation is entirely derived from rainfall, averaging about 200 inches per annum, and stored, within the catchment areas.

The engineering works connected with the Tata power projects are situated at Lonavla, above the Bhor Ghat in the Western Ghats of the Bombay Presidency. The rainfall is stored in three lakes at Lonavla, Wlawan and Shirawta, whence it is conveyed in masonry canals to the forebay, or receiving reservoir. The power house is at Khopoli, at the foot of the Ghats, to which the stored water is conveyed through pipes, the fall being 1,725 ft. The present capacity of the plant installed here is 70,000 h.p., but the duplication of the pipe line and installation of additional machinery is under way. To develop the original scheme, a northward extension was undertaken, called the Andhra River project. A dam about ½ mile in length and 192 ft. high was built across it. In this instance the draw-off point is 11 miles up-stream from the dam, at a level of 112 ft. above the lowest river bed. The water is taken through a tunnel 8,700 ft. in length, driven in solid trap rock through the scarp of the Ghats, whence it enters the pipes for a vertical drop of 1,750 ft. to the generating station at Bhiviri, which is about 17 miles from the Khopoli station. The scheme is designed to yield 100,000 h.p. in its full development, but its present capacity is 60,000 h.p. The latest development is the Tata Power Company's scheme, which came into operation last year. This is a southward development of the original scheme, and is known as the Nila-Mula project, owing to the fact that the waters of the Nila and Mula Rivers were dammed for the conservation of water for it. A 150-ft. dam closes the outlet from a catchment valley, which originally provided the sources of the two rivers which form a junction at the dam site. A 4,000-ft. approach cut and 15,000 ft. of tunnel lead the water to a pipe line descending to a power house containing five generating units driven by double overhung Pelton wheels operating on a static head of 1,640 ft. Four 30,000-kVA transformer banks step the voltage up to 110,000 for transmission over a double tower line to a receiving station at Dharavi in Bombay, where it is stepped down to 22,000 V for underground cable distribution in conjunction with the Andra Valley Company's supply. It is noteworthy that the three power schemes are interlinked, and a constant supply is thus ensured. Of the total capacity of the present three plants, only two-thirds is utilised, but an increase in load is anticipated owing to the electrification of railways in the Presidency, and it is thought that within the next ten years the whole of the surplus will be utilised.

South Indian Railway Electrification.

It has been announced that the South Indian Railway suburban electrification scheme has almost been completed on the Egmore to Madras Beach section, and will shortly be opened for traffic. The power will be supplied by the Madras Electric Supply Corporation, in the first instance, to two sub-stations being built at Egmore and Minambakkam.

Electricity in the United Provinces.

Progress in electrical development in the United Provinces is reported from Muttra, Jubbulpore, Agra, Allahabad and Lucknow. At Muttra underground mains have been installed and the total number of connections is 229. At Jubbulpore the erection of the second 1,000-kW turbine set is well in hand. The extensions of the building at Agra have been completed, and the 200-kW vertical oil engine is in course of erection, the underground cable having been completed. The U.P. Electrical Supply Company supplies electricity to Allahabad and Lucknow. At the latter town the erection of the first set transferred from the Allahabad Station has been completed and the plant put into commission. Two rotary convertors are also in operation, and extension of distribution mains is being carried out. At Allahabad the turbine plant and the mercury arc rectifier are working satisfactorily.

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The National Radio Exhibition.

A commentary on the progress made by British manufacturers during the past year as revealed by the recent display at Olympia, London.

By ERNEST W. BRAENDLE, A.M.I.E.E.

THE organisers of the National Radio Exhibition this year are again to be complimented on the general arrangements made for, and evidently appreciated by, the crowds which flocked to Olympia from all sources. Their system of simultaneous supply of music to the individual stands was extremely useful in enabling one to compare readily the relative merits of the dozens of loud-speakers and loud-speaking equipment being demonstrated. The provision of individual studios for those exhibitors desirous of utilising their own programme of entertainment was also a happy innovation at this year's show.

It would be impossible to detail at reasonable length the multitude of interesting things on view, but it is hoped to be able to indicate the general progress made by manufacturers in the past year with possible brief references to one or two outstanding items.

It is interesting to note that the general tendency this year is towards a reduction in size of the individual components, and it is especially noticeable in the case of inductance tuning coils, which were previously tending to become unduly large. The general finish of components is good, and more attention is being paid to electrical detail.

Battery eliminator and charging equipment, both complete and in individual units, were fairly prominent features, and it is satisfactory to note that they are now being designed on more liberal and substantial lines. Mains transformers, smoothing chokes, and condensers are now available for almost any combination of input and output requirements. The increasing use of the Westinghouse "contact" rectifiers for both high and low voltages is very noticeable, as is the recent decrease in price of the individual units.

Except in details, there seems to have been little development in valve manufacture. Certainly there were all varieties of screen-grid, pentode, and the smaller types of valves, but no reasonably-priced power valve suitable for, say, 500 to 600 volts anode pressure and for direct operation off a.c. supply mains is yet available. Also, very little progress seems to have been made in the way of improved neon lamps and photo-electric cells.

Of the more serious type of set, designed for first-class reception of our local stations, there was little to be seen. With the exception of radio-gramophone sets, of which there were a great many, the general tendency seems to be for small, compact, multivalve, portable, semi-portable, and permanent sets, the last named often designed for direct operation off the domestic mains.

A very interesting entertainment, unfortunately only open to the trade, was a demonstration of the Baird system of television. A complete studio and operating room were arranged in such a manner that it was possible to see the artists, the operator, and the televisor receivers in turn by just moving the head. When we consider the early stage of its development, the lack of experimental facilities, and the general difficulty in this country of financing early experimental work of this type, the resulting demonstration was extremely good. The size of the reproduced image is very deceptive, since it is seen through a magnifying lens, but it is sufficiently large and has sufficient detail to provide an easily recognisable likeness of the transmitted image. The relative detail compares very favourably with that of the early broadcast transmission of speech and music in the days, so convenient to forget, when Capt. P. P. Eckersley used to run up and down the scale on the studio piano and inform us that we couldn't hear more than about two-thirds of it. It is, therefore, interesting to note that the B.B.C. is now giving experimental television broadcasts. Unfortunately, the B.B.C. realises that the average listener is not likely to agree passively to the loss of an hour of his alternative programme in aid of progress, with the result that these transmissions take place between 11 and 11.30 a.m. during the week, a time of little use to anybody except experts engaged on the work and a few enthusiasts with sufficient leisure.

The main feature of interest, at any rate from the public point of view, was loud-speakers, of which multitudes were to be both seen and heard. Since it is in this direction that the main development of the past year seems to have taken place, it may be of interest to criticise this aspect a little more fully.

The general trend of design for all types of loud-speaker has apparently been based on the public demand for bass, treble, and increased volume-handling capabilities, which, coupled with the demand for loud-speakers enclosed in large cabinets, has not tended to improve the overall quality.

There seems to have been very little development, from the point of view of quality, of the reed-driven type and, although some manufacturers have certainly increased their volume-handling capacity, one and all suffer from the familiar "cone" quality, and in no case do they approach the average moving-coil type. Serious resonances in the middle scale have to a certain extent been eliminated, but, since they have been replaced by others in both the bass and treble, the result is not altogether satisfactory. One type even goes so far as to employ a number of definite resonant points, presumably on the principle that a few more or less do not matter; although the effect is not very noticeable in the case of music of the dance variety, the tones of a speaking voice trip most definitely from point to point, providing a quite ludicrous effect.

The "Baker-Selhurst" and the "Celestion" coil-driven speakers are undoubtedly good for commercial productions, but in the majority the development of treble, or bass, or both, has been carried to a very illogical conclusion. Certain of the bigger exhibitors seem to be under the impression that their names are sufficient warranty for their products, and their moving-coil speakers, besides being extremely crude in the matter of finish, have every appearance of requiring nothing short of a complete power-generating plant to operate them.

In connection with coil-driven loud-speakers, the Telegraph Condenser Co., Ltd., exhibited a 500-microfarad electrolytic type of condenser, suitable for operating on a 40-volt d.c. supply, which should be most useful for eliminating "ripple" from the field windings; although the new condenser has a considerably increased factor of safety, the danger of suddenly breaking the field circuit cannot be sufficiently emphasised.

The B.B.C. exhibit was very disappointing, as compared with former years, as was the general lack of interest shown in the exhibition by manufacturers of transmitting equipment. There were, however, a few examples of 400- to 500-watt power-amplifier equipment for kinema and theatres on view.

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On the whole, one left Olympia with the feeling that the Exhibition was not as satisfying as in previous years, although the impression may have been partly due to the simultaneous presence of the Engineering and Shipbuilding Exhibition in the adjoining hall. It is felt that a little more attention paid by both exhibitors and salesmen alike to the requirements of the man of moderate means would go a long way to improve the general atmosphere.

Notes on the Exhibits.

(*Concluded from page* 583.)

Hart Accumulator Co., Ltd.

Experience continues to demonstrate the advantages and popularity of the glass-container type of filament accumulator. Assembled in specially moulded pressed-glass boxes with sealed glass lids, "R.M.E." cells are fitted internally with moulded ribs, or grooves, extending almost to the bottom of the box; between them the plates rest, and thus the use of separators and bottom blocks is entirely obviated, and in consequence larger space is available. The provision of vaseline cups, which prevent the corrosion of the terminals, is yet another excellent feature.

The "R.A.O." type of high-voltage accumulator cells, having a capacity of 1,250 milliampere-hours, are contained in

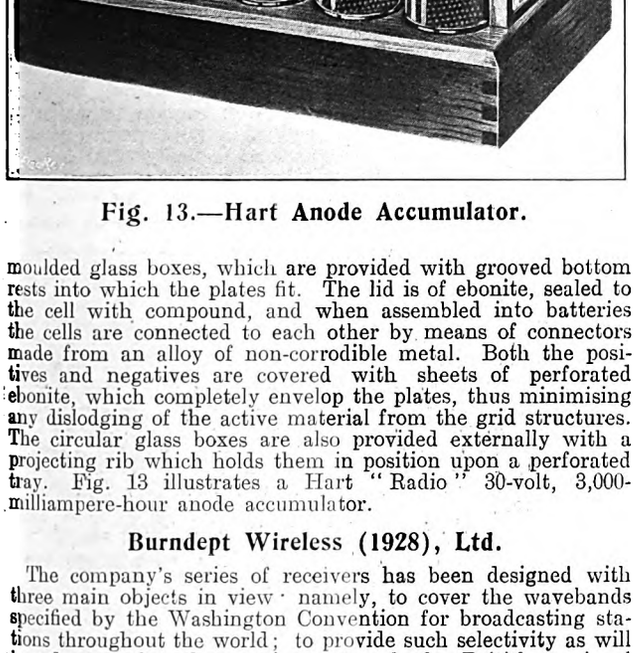

Fig. 13.—Hart Anode Accumulator.

moulded glass boxes, which are provided with grooved bottom rests into which the plates fit. The lid is of ebonite, sealed to the cell with compound, and when assembled into batteries the cells are connected to each other by means of connectors made from an alloy of non-corrodible metal. Both the positives and negatives are covered with sheets of perforated ebonite, which completely envelop the plates, thus minimising any dislodging of the active material from the grid structures. The circular glass boxes are also provided externally with a projecting rib which holds them in position upon a perforated tray. Fig. 13 illustrates a Hart "Radio" 30-volt, 3,000-milliampere-hour anode accumulator.

Burndept Wireless (1928), Ltd.

The company's series of receivers has been designed with three main objects in view namely, to cover the wavebands specified by the Washington Convention for broadcasting stations throughout the world; to provide such selectivity as will be adequate for the requirements of the British regional scheme of stations; and to comply with the I.E.E. Regulations applicable to mains-operated sets. The new a.c. mains model receiver is original in design; it uses seven valves, two screen-grid h.f. stages, anode-bend detector, a r.c. stage with two super-power valves arranged for push-pull output, and a rectifier in the power unit. The receiver, together with an excellent loud-speaker and rotational frame aerial, is housed in a cabinet of fine finish. A single drum is used for tuning and a four-position switch brings into circuit wave-ranges of 200-330, 310-550, and 1,050-1,900 metres, and also arranges the instrument for gramophone amplification. The further controls are for volume and rotating the frame aerial. The instrument has a compact lay-out and is so designed that the complete chassis can be supplied for incorporation in customers' own cabinets if desired.

The "Ethogram" (model B) is, in point of fact, the same instrument, power unit, frame aerial, and loud-speaker, with the addition of an efficient electric gramophone motor; thus, the cabinet is slightly larger. A new "pick-up" is used, of the "needle armature" type. In order to avoid mechanical resonance, the ordinary armature has been done away with, thus ensuring that any resonant frequency set up will be outside the audible range. Such essential points as tracking angle, needle angle, pressure on record, and freedom from tone-arm resonance have been studied, and for that reason the device is sold only complete with a tone-arm.

The "Universal Screened Five" has been designed for the discriminating user who desires all-round performance; accordingly, no attempt has been made to reduce the number of controls. It is an open-aerial set and is supplied in two forms—for battery operation and direct from a.c. mains. The former utilises five six-volt valves, and a milliameter is included on the panel to enable any overloading of the output to be seen at a glance. The wave-lengths covered are 16-38, 220-560, and 850-2,100 metres; there are no coils to change, as the various ranges are brought into circuit by means of a special switch.

For powerful receivers and radio-gramophones the moving-coil loud-speaker generally finds most favour, but in other respects the new "Minstrel" speaker is attractive, for it requires no field current supply and its sensitivity is an advantage, as a large volume of undistorted sound is obtained with very moderate battery power applied to the receiver. Moreover, its two specially-treated linen diaphragms are carefully proportioned to give respond to the full range of musical notes, without unpleasant pronounced emphasis of any one. The movement is of the balanced-armature type, and a satisfactory adjusting screw is provided

The new screened portable set is new in design and has a better appearance and performance than the 1928-29 model. The case is made of small-grained imitation crocodile leather, finished blue, suitcase type, and all valves and batteries, although easily accessible, are covered by a panel; only the tuning controls protrude; drum controls are used, being calibrated direct in wave-lengths, and a new type of loud-speaker is used.

Edison Swan Electric Co., Ltd.

The combination of the three well-known radio manufacturing resources of the "Ediswan," B.T.-H. ("Mazda"), and Metro-Vick ("Cosmos") companies has resulted in the production of new lines. Their components are familiar to the public, and the new receivers are well made, of good appearance, and retail at attractive prices. Their safe and simple all-electric equipments are serviceable sets which dispense entirely with batteries. The all-electric a.c. transportable set is completely self-contained with a cone loud-speaker, and no batteries of any kind are used. Those who are unable to avail themselves of mains operation should consider the 3- and 4-valve battery models; they are powerful, simple to operate, and ensure a good standard of reproduction.

The 3-valve all-electric a.c. and d.c. sets are neat in appearance and easy to operate with the average loud-speaker. An important feature embodied in each set is the variable loose-coupled aerial tuning, which, in addition to ensuring selectivity, acts as a volume control. Each set is self-contained, and may be used in conjunction with an electrical pick-up for reproducing gramophone records; volume control for use with the pick-up is embodied. A variable choke feed is embodied, and the metal cabinets screen the circuits from hand-capacity effects.

In the case of a.c. mains-operated sets, all the valves employ a.c. for filament heating, the indirectly-heated cathode system being employed for screen-grid and detector valves, thereby eliminating ripple and consequent background noises. The eliminator employs a full-wave rectifying valve and is capable of correct adjustment to suit the voltage of the electric light mains. It is of the plug-in type, to facilitate easy replacement in the event of an alteration in supply conditions or voltages, due to change of residence or other causes. The set is fitted with a removable back, with interlocking plug, which provides a very efficient safety device, making it impossible to get access to the internal parts of the set until the supply has been disconnected. Each set is fitted with a fuse in the mains circuit, and is supplied with 20 ft. of flex with cord switch and adaptor for plugging into an ordinary lampholder.

In the self-contained d.c. set indirectly-heated cathode screen-grid and detector valves are used in the first two stages, a pentode being employed in the output stage. Insulation, which is so important on d.c. mains sets, is provided for, and a safety device consisting of an interlocking plug in the removable back ensures safety in operation. The loud-speaker is completely isolated from the mains by two condensers, and the aerial is definitely earthed to avoid mains interference on the negative side of a three-wire system, and to avoid any possibilities of short circuit or shock from the aerial itself.

Ferranti, Ltd.

This company's new Model 31 a.c. mains receiver is of quite small overall dimensions when it is considered that all the necessary battery eliminator components are incorporated in it. Its neat appearance will be judged from fig. 14. Except that a.c. mains valves are used, the circuit is generally similar to that of the company's screen-grid 3-valve set. One h.f. transformer-coupled screen-grid stage is followed by a grid-leak detector and one audio-frequency stage, the output being fed to the speaker through a suitable multi-ratio output transformer. The use of h.f. transformer coupling is an

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unusual feature, transformers having been specially developed for the purpose. Astatic windings are used to avoid any tendency to self-oscillation, especially on the long waves. H.f. transformer coupling results in greater inherent selectivity, avoiding the necessity for critical action, and at the same time makes the receiver more easy to operate from the mains. Reaction is obtained by the differential method, which enables the capacity between the anode of the detector and earth to be kept constant, irrespective of the amount of reaction applied. This has the advantage of maintaining the efficiency of rectification under all conditions and at the same time of avoiding the variable loss of the higher audio frequencies, which undesirable cut-off, when it happens, is additional to that produced by very sharp tuning. The anode feed system, which has been largely developed by Ferranti,

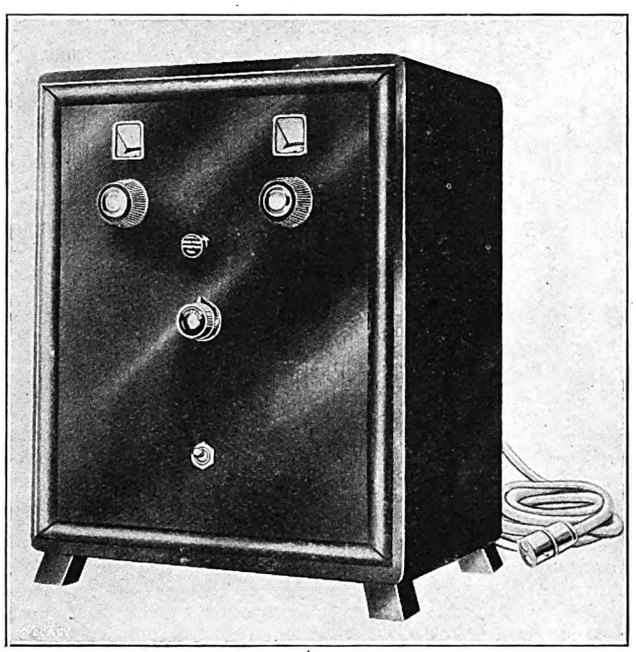

Fig. 14.—Ferranti A.C. Mains-driven Receiver.

Ltd., is incorporated, and prevents back coupling between the stages, which commonly produces whistles and generally poor reproduction. The system has the additional advantage of preventing the valves from being burnt out accidentally, for example, if there is a "short" inside the screened-grid valve. The set is designed for fitting in a polished wood cabinet of standard size, metal cabinets and panels having been deliberately avoided in view of possible danger in the case of receivers operated from the mains, and also because their use might be the cause of the accidental destruction of the valves.

Igranic Electric Co., Ltd.

An entirely new production, comprising a three-valve all-mains receiver employing screen-grid h.f. and pentode valves, was shown in table cabinets and in handsome bureau type, the latter incorporating electric gramophones and a newly-patented self-contained frame aerial.

The "Neutrosonic Seven" receiver was shown in its standard transportable form with combined battery box, frame aerial, and loud-speaker, and also in table and bureau cabinets.

The portable receiver "De Luxe" possesses interesting features which render it suitable for outdoor use and also for permanent use in the home. Two screen-grid valves are employed in the h.f. stages, and it is essentially a long-range portable receiver with the added merit of quality reproduction. An efficient receiver designed for short-wave reception only employs a screen-grid valve in the h.f. stage, and is capable of receiving from all parts of the world. Examples were shown of "all-mains" receivers, both two and three valve, for operation with outside aerials, and also "Igranophone" electrical reproducing equipment for domestic use and for use in kinemas, dance halls, &c.; single and double turntable units were exhibited, together with power amplifiers of various types. Transverse-current microphones and control units have been specially designed for use in conjunction with amplifying equipment used for band-repeating work. A wide selection of new mains units and battery chargers, together with such components as power transformers, smoothing chokes, potential dividers, &c., for the home construction of mains units was on view, and the dual-wave inductance coil is a new product of considerable interest; as its name implies, it is a dual-range coil covering both the normal and higher broadcast wavebands. The coils are enclosed in a neat bakelite casing, and it has been designed to take the place of the six-pin coil, but without the disadvantage of having to change coils, the change-over from one waveband to another being effected by means of a switch. Amongst other components may be mentioned especially the "Megostat," a variable high-resistance for use more particularly as a volume control, which is specially designed so that the resistance value remains constant under all conditions.

The "Pentoformer" is an output transformer specially designed for use with the popular pentode valve, and there was also a varied display of stand-off insulators, jacks and plugs, switches, "Indigraph" terminals and sockets, frame aerials, and absorption wave-meters.

Graham Amplion, Ltd.

Last year this company introduced the "Lion" cone-diaphragm loud-speaker. This season it has commenced to manufacture receivers for the first time. The four models are the 5-valve, 4-stage, a.c. mains set and the 4-valve, 4-stage, battery set, both of all-metal construction, with provision for the use of a gramophone pick-up. The 6-valve, 5-stage, a.c. cabinet set is self-contained with an aerial supported within hinged box panels at the sides of the speaker cabinet. The radio-gramophone is a similar handsome instrument, incorporating an electrically-driven turntable and "Electravox" pick-up. The a.c. sets make use of British Westinghouse metal rectifiers and comply with the I.E.E. safety rules; all have wavelength ranges of 200 to 560 and 1,000 to 2,000 metres, with a change-over switch. Screen-grid h.f. valves are utilised, and the last two super-power l.f. valves operate in parallel, allowing a dissipation of 10 watts.

The sets are not difficult to control, the drum-type dials being calibrated in wavelengths, and their selectivity is ample for the requirements of the "Prague plan," *i.e.*, station separation of 10 kc. They are said to have been produced to convince the sceptic and to do justice to the AB.6 and "Lion" speakers, and Mr. P. K. Turner is certainly to be congratulated on their design and lay-out, which are of a thoroughly engineering character. The power of the mains-driven sets is such that the music of an orchestra of some 20 performers can be reproduced at its original strength, if required; while the quality is such that distortion is below the observable limit. Notes are reproduced as they are broadcast, and all notes from E below the bottom A of the piano (*i.e.*, frequency 20) to C, over an octave above top C of the piano (*i.e.*, frequency 8,700), are reproduced equally so far as the human ear is capable of judging.

The circuit is in most respects quite normal, but several interesting devices have been incorporated. For instance, in order to avoid detector distortion, it is necessary to leave the l.f. amplification fixed; accordingly, both volume and selectivity controls are obtained by varying the aerial coupling. When designing the coupler, care was exercised to avoid possible coupling between the long- and short-wave coils, and so within the short-wave coil a small condenser has been placed to compensate for any difference between the self-capacities of the two coils. The long-wave coil is made with special wire having a quadruple covering, to obtain the best air spacing, while the use of reaction to widen the power range and sharpness justified a fairly high-resistance anode coil, which also saves space; actually two coils are employed, in parallel with negative coupling for short waves and in series with positive coupling for long ones. The unorthodox method of obtaining selectivity partly by reaction

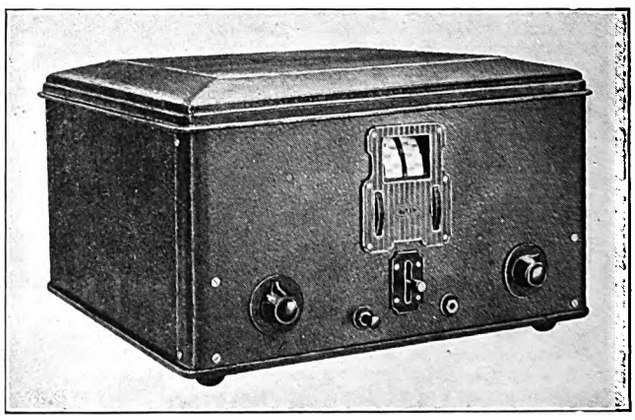

Fig. 15.—"Amplion" A.C. All-metal Receiver.

and partly by the loose-coupled aerial circuit has unexpected advantages, making the sets both easy and interesting to operate; it necessitates very careful reaction arrangement, but the sets are well screened.

Perhaps the most unusual feature is the use of grid rectification in place of anode bend, for quality rather than selectivity, and the designer claims to have proved his preference. The all-metal construction of the sets frees them from "hand effect," while internal screening and the use of filters to prevent h.f. feed-back assist stability. The drum-drive condenser assembly is noteworthy, and the combined wave-range and gramophone switch is of a new well-made universal pattern.

The final result is illustrated in figs. 15 and 16, which show the a.c. receiving set and a set of curves that indicate the comparative output the set is capable of when supplied with

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a carrier (actually at about 300 metres) modulated with a pure note of varying audio-frequency. Curve A was plotted at low selectivity, *i.e.*, strong aerial coupling without reaction. The dotted line shows a drop of 6 T.U., the least perceptible falling off for a normal ear; the middle part of the curve represents 100 per cent., and it will be appreciated that no

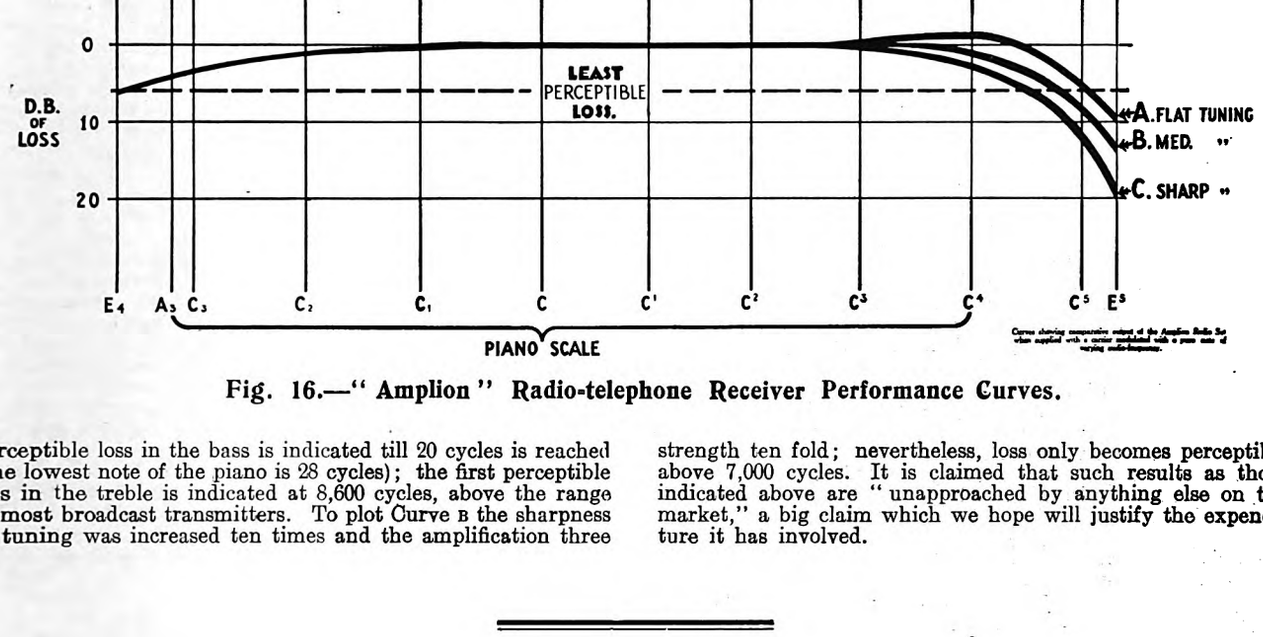

Fig. 16.—"Amplion" Radio-telephone Receiver Performance Curves.

perceptible loss in the bass is indicated till 20 cycles is reached (the lowest note of the piano is 28 cycles); the first perceptible loss in the treble is indicated at 8,600 cycles, above the range of most broadcast transmitters. To plot Curve B the sharpness of tuning was increased ten times and the amplification three times, by reaction and coupling adjustment, the effect on the extreme treble being obvious: the first loss occurs at 7,700 cycles, instead of 8,600, and for this reason the amplifier was designed to "hump" at 5,000 cycles as shown in curve A. The extreme condition is represented by Curve C, when the sharpness had been increased one-hundred fold and the strength ten fold; nevertheless, loss only becomes perceptible above 7,000 cycles. It is claimed that such results as those indicated above are "unapproached by anything else on the market," a big claim which we hope will justify the expenditure it has involved.

The British 132-Kilovolt Grid.

Extracts from a paper read before the International Conference on Large Electric Systems held in Paris in June, 1929.

By J. R. BEARD, M.Sc., M.I.E.E.

(*Concluded from page* 585.)

Sub-station Connections and Number of Transformers.—As switchgear forms such a large part of the capital expenditure on the grid, much consideration has been given to reducing it to a minimum. Many of the tapping points will consist of a simple loop-in of a single line, and conditions favour the use of a three-circuit breaker arrangement. The by-pass connection is normally kept open, and one transformer switch and the section switch must open automatically in the event of a fault occurring in either a line or a transformer. This arrangement utilises the minimum of apparatus consistent with rapid resumption of service after a fault, and has been chosen because of the saving in cost, the reduction of maintenance charges, and the decreased number of danger points brought about by the simplification. The by-pass connection is intended for use only if one transformer is out of commission, and provision has to be made for feeding the remaining transformer from either feeder.

A duplicate supply can be given either by two transformers, each large enough to deal with the whole load, or by three transformers, each large enough to deal with half of the load. The accompanying table based on actual contract prices shows the relative costs of various alternative arrangements.

CAPITAL COST OF 132 kV. TRANSFORMING STATIONS.

Including Allowance for Capitalised Transformer Losses and for Two Incoming 132 kV. Feeders and the necessary Lower Voltage Switchgear.

Type of station.	132 kV circuit breakers	Transforming station to give duplicate supply of					
		60,000 kVA		30,000 kVA		15,000 kVA	
		Transformers installed kVA	Cost £	Transformers installed kVA	Cost £	Transformers installed kVA	Cost £
L.N.E. (low non-extensible)	3	2 × 60,000	70,600	2 × 30,000	52,000	2 × 15,000	45,200
L.E. (low extensible)	3	2 × 60,000	73,300	2 × 30,000	54,700	2 × 15,000	47,900
L.D.B. (low double busbar)	5	2 × 60,000	81,800	2 × 30,000	63,100	2 × 15,000	56,300
" " ...	6	3 × 30,000	92,000	3 × 15,000	73,200	3 × 15,000	66,500
" " ...	6	3 × 30,000	89,900*	3 × 15,000	71,500*	3 × 15,000	65,500*

* Allowing for reduction in iron losses by keeping third transformer in commission for only one-third of time.

The minimum spacing between conductors of different phases is 9 ft., and that between any live metal, other than arcing horns and rings and earthed metal, is 4 ft. 6 in.

The main circuit-breakers are built up of single-phase units. Their rated rupturing capacity is 1½ million kVA. The tanks are mild-steel cylinders with cast-steel covers of the same strength as the tanks. Each tank is fitted with valves and screwed caps for coupling it to the oil filtering and storage plant. Circuit-breakers of both the explosion-pot and multiple-break types are being used. The circuit-breakers are normally operated from a 110-volt storage battery; they can be controlled either locally or from a remote point, but not from both points simultaneously. Hand operation can be resorted to in the event of failure of the electrical gear. The normally operated isolating switches are of the rotating centre pillar type. The isolating switches are interlocked with the main circuit-breakers, so that it is possible to make or break current on an isolating switch.

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On double-busbar equipments the switches are interlocked, so that it is impossible to make a connection to both busbars at the same time. Further interlocks are provided to prevent a transmission line earthing-switch being opened or closed until the isolating switch on the line is open, or a by-pass switch being opened or closed unless the parallel circuit is complete.

The current transformers are of the single-turn bushing type fitted over the insulators of the primary conductors. The standard full-load secondary current is 0.5 A. Potential transformers are connected to the lower voltage side of the main transformers. The equivalent transformation ratio is 132,000/110 kV, and the secondary winding is tapped to correspond to the tappings on the main transformers. Potential transformers are also compensated to allow for the voltage drop in the main transformers, so that their secondary voltage is a true measure of the line voltage.

All transformers are designed for outdoor working and for transport by road or by rail over all the main British railways. The transport problem is a difficult one, as the British loading gauge is very much more restricted than Continental and American gauges. Special trucks are being constructed by the railways for dealing with the largest sizes. The transformers are slung from narrow, deep, removable side girders, so that the maximum width is available and the transformers can extend to within a few inches of rail level. Wherever possible siding connections are arranged to the transforming stations, but where this is impossible delivery is made by road, although this is more expensive. It has been found possible to meet the limiting conditions with three-phase transformers up to 75,000 kVA.

Up to half output, or slightly more, the transformers operate as naturally cooled units, but above this load forced cooling is brought automatically into operation. This forced cooling consists of an air blast which is normally combined with forced oil circulation through separate oil coolers, but in some instances the air blast is applied directly to radiators on the transformer tanks. Normally, the forced cooling is not in operation, as, with two transformers in commission, of which one can deal with the whole load, each transformer is normally only half loaded, even at peak load. Air-blast cooling has the advantage that no water supply is required, and risks due to corrosion and leakage are reduced.

For transformers of 10,000 kVA rating and less the usual arrangement is to instal standard transformers of double the capacity required, but without the cooling plant. All transformers are equipped with voltage-regulating gear for altering the ratio from 10 per cent. below normal to 10 per cent. above normal in steps of 1.43 per cent. As a rule this is being carried out by on-load tap changing on the 132-kV windings. This regulation is required partly for dealing with voltage regulation on the 132-kV system, and partly to correct for voltage drop in the transformer itself and to give the necessary variation in the local supply voltage.

The 132-kV windings are star-connected, and the neutral point is connected permanently and directly to the transformer tank and earth. This simplifies the voltage-regulating equipment and enables the size of the transformer to be appreciably reduced, thereby facilitating transport arrangements. It also effects an appreciable saving in cost, amounting to at least £500,000 for the whole grid.

Experience with multiple earthing on lower voltage systems has shown that directly earthing the neutral results in more rapid and certain disconnection of faults, and that it is preferable to an insulated-neutral system, even as regards minimum interference with communication circuits.

Two temperature indicators are fitted to each transformer which register the temperature of the oil near the top of the transformer and the highest temperature within the transformer windings. An alarm device gives warning in the event of the winding temperature reaching a predetermined value, and can be arranged to close the tripping circuits of the circuit-breakers controlling the transformers.

Except at three-shift power stations, where permanent earthing facilities exist, a separate earthing transformer is provided for the lower voltage side of each 132-kV transformer. This transformer has a main interconnected-star winding, which is directly connected to the lower voltage side of the power transformer, and an auxiliary star-connected winding to give 400 volts three-phase and 230 volts single-phase.

The earthing transformer can carry the full auxiliary load continuously, and any earth fault current for 15 sec. Where earthing transformers are not required, small unit transformers are provided for auxiliary supplies.

Lower Voltage Systems.—The lay-out is determined on similar principles to that of the 132-kV system, although they partake more of the nature of transmission and distribution networks, and less of the nature of load transfer and equalising busbars. In general they consist of overhead lines operated at 33-kV. A trial is being made on certain lines of reinforced-concrete poles of the hollow spun type. The majority of the lines have steel-core aluminium conductors on narrow-base steel masts and suspension insulators of the three-unit cap and pin type.

In the central parts of London, due to the concentration of generating plant, the load transfers are equally as large and important as those dealt with by the 132-kV system; an extensive 66-kV cable system is being installed, comprising some 100 three-phase circuit miles. Single-core cables are used throughout. These have waterproofing coatings over the lead, and are generally laid direct in the ground with a heavy reinforced-concrete protecting cover some 3 in. above the cables. The three cables forming each three-phase circuit are bound closely together in triangular formation, and the lead sheaths are cross bonded at each set of joints. The phases are transposed at each joint, a complete rotation being effected over each three drum lengths. Part of the cables are of the oil-filled type with 0.355 in. dielectric thickness and a double lead sheath with copper tape armouring between the sheaths. The greater portion, however, is of the more usual construction with 0.65 in. dielectric thickness and a single lead sheath under which is a wrapping of metalised paper. There are to be sixteen transforming stations stepping down from 66-kV to lower voltages (mostly 6.6-kV) or vice versa, but extensive use is being made of transformer-feeder units, in which a transformer is directly and permanently connected to its associated feeder wihout the intervention of switchgear. In consequence, 66-kV switching has been restricted to seven centres where the busbars and isolating switches are in buildings, but the circuit-breakers are out of doors. The circuit-breakers have the same rupturing capacity as those on the 132-kV system, *i.e.*, 1,500,000 kVA.

The installed capacity of 66-kV transformers will be some 950,000 kVA in three-phase units varying in size up to 45,000 kVA. The general arrangements of connections for cooling and on-load tap changing follow closely those described for the 132-kV transformers, except that the 66-kV system is intended to operate with the neutral point earthed through resistances; the insulation of the 66-kV windings at the neutral point is, therefore, made capable of withstanding the full phase voltage of 38 kV. The range of voltage regulation is plus and minus 7½ per cent.

Line Protection.—Delay in isolating a fault of two seconds will almost inevitably result in the falling out of step of synchronous load. The vast majority of faults on the 132-kV lines will undoubtedly be insulator flashovers, the major portion of which will cause no permanent damage if the flashover is not prolonged. Quick switching will therefore result in the majority of interruptions being of only a temporary nature, but delayed switching will result in long time shut-downs, pending replacement of insulators.

Two conclusions were arrived at :—

(1) That a balanced protective system of the Merz-Price type employing pilots offered the soundest solution, but that the cost of providing separate pilots would be very large if it were generally applied;

(2) That the only non-pilot scheme which could be considered as a practicable alternative was some form of impedance protection, and that for this to be satisfactory the definite isolation of a faulty section should be secured in a maximum period of one second.

Further investigation and development of impedance schemes resulted in considerable advances, and it is believed that satisfactory arrangements have been developed which will give discrimination and isolation, within the time limit specified, in all conditions, except possibly where simultaneous faults develop or where the length of 132-kV line is less than 10-12 miles.

Accordingly pilot protection has been adopted for line sections of 12 miles or less, and impedance-type protection elsewhere. The latter is also used throughout the 66-kV cable system in the London area.

Where lines are directly connected to transformers, separate transformer protection and separate feeder protection are provided. The line protection is of the pilot type and an additional pair of tripping wires is included in the pilot cable to couple up the feeder and transformer protective relays. The line protective gear is designed for a minimum fault setting of 400 A and a maximum section length of 50 miles, and to be stable with through currents up to 7,000 A.

Two forms of pilot-wire protection have so far been adopted : "split pilot" and "translay." Three major difficulties affect the design of pilot protective gear :—

(*a*) Balance of current transformers;
(*b*) Pilot capacity;
(*c*) Surges and resonant transients.

The forms of protection adopted have interesting features in this connection.

With "split-pilot" protection, air-gap transformers having a straight-line ratio characteristic are employed to ensure satisfactory balancing of current transformers. The "split" return ensures that pilot capacity currents oppose and cancel in the split pilot transformer.

High-frequency effects are provided against by tuning the relay circuit to 50 cycles in such manner that the operating current increases very rapidly for frequencies which differ materially from the fundamental. The relay circuit is electrically independent of the pilots.

With "translay" protection, an induction wattmeter type relay is employed, the main windings of which are directly connected to the protective current transformers of the standard closed-core type. A secondary winding is wound on the centre line of the relay iron circuit, which draws its energy by transformer action from the first winding. This secondary winding is connected to the pilot cores through the second winding of the relay.

The pilot voltage and current can be made very small, thus limiting capacity effects. Since any capacity current flow will lead the primary current by a large angle, the torque produced in the wattmeter relay will be small.

To compensate for unbalance of the current transformers a small additional winding is added on the outer link of the

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relay iron circuit, which is short circuited through an adjustable resistance. The current induced in this circuit acts as a bias, increasing the setting of the relays in proportion to the magnitude of the fault current.

High-frequency compensation takes the form of a tuned shunt or similar device.

Two forms of impedance protection have so far been adopted: "ratio-balance" type* and "definite impedance" type.

The chief feature in which "ratio-balance" impedance protection departs from the usual form is that the action of the relay is made dependent on the reactance of the line, *i.e.*, on the factor V sin ϕ/I and not on the impedance.

Certain experiments in recent years have suggested that power arcs may possess considerable resistance. Whilst there is considerable doubt on this point, such an effect would tend to produce faulty discrimination, and the object in adopting a reactance base is to eliminate the effect of resistance.

The ratio-balance relay comprises a time discriminating element in the form of a wattmeter movement designed to respond instantaneously when the measured reactance value corresponds to less than 75 per cent. of the protected line section. For faults outside the 75 per cent. zone, including those on adjacent sections, a clockwork mechanism gradually increases the operational ratio of the time discriminating element by means of a variable rheostat and thus causes the relay to operate in a time dependent on the distance of the fault from the relay. This feature provides "back up" protection for adjacent sections.

A definite impedance relay functions instantaneously if the fault impedance value corresponds to less than 90 per cent. of the section of line protected and functions with an inverse time characteristic if the fault lies outside this zone.

Directional elements are employed in both schemes and the voltage supply required for phase-fault protection is obtained from potential transformer connected to the lower voltage windings of the main transformer. The ratio of this transformer is automatically adjusted to correspond to the particular ratio in use on the main transformer and, in addition, a compensating device is included to cover load drop in the transformer.

Transformer Protection.—The combination of bushing type current transformers and a tapping range of 20 per cent. on the main transformers makes it difficult satisfactorily to apply circulating-current protection to the power transformers, unless current transformers can be accommodated in the main transformers, which is difficult of general application.

Accordingly the protective scheme decided upon provides overload protection having an inverse time feature and an adjustable definite minimum setting, together with restricted earth leakage protection for each winding of the transformer. Where the winding is earthed, the leakage protection is restricted to the winding itself by leading the resultant secondary current from the three overload current transformers through the secondary of a current transformer mounted in the earth connection. The overload feature is given a minimum setting of two seconds to secure discrimination with the line protective gear.

Metering System.—The Board's metering system must be capable of measuring over half-hourly periods kWh, kW maximum demand, and reactive kVA maximum demand. From the kW and reactive kVA maximum demand measurements, the power factor at the time of maximum demand will be computed.

In cases in which a supply authority is the owner of a selected generating station the metering arrangements are more complicated because the supply authority has the option of purchasing such of his requirements as are generated in the station at the actual cost of generation, adjusted according to the load factor and power factor of the supply authority's own load.

The Board's metering system for a supply authority owning a selected station must measure separately the following quantities:—

(*a*) The kWh, kW maximum demand, and reactive kVA maximum demand of supplies taken by the supply authority from the Board's transmission system.

(*b*) The kWh, kW maximum demand, and reactive kVA maximum demand of supplies taken from the generating station by the Board's transmission system.

(*c*) The kWh, kW maximum demand, and reactive kVA maximum demand of the generating plant in the station (after deducting the energy used by the station auxiliaries).

The quantities measured under (*a*) represent that portion of the supply authority's consumption which is definitely chargeable at the Board's tariff. The total consumption of the supply authority (*i.e.*, the output to its feeders) is obtained by respectively adding to, or subtracting from, the output of the generators (less auxiliary services), the import from (*a*), or the output to (*b*), the Board's transmission system. The difference between the total consumption of the supply authority and that portion of its supply measured under (*a*) represents that portion which it has the option of paying for at adjusted station costs. The quantities measured under (*c*) enable the generating costs of the station to be computed.

The readings from individual kW and reactive kVA maximum demand meters are added or subtracted by automatic means, in order that each summated reading may correctly represent the simultaneous readings of individual measuring instruments.

For this purpose kWh meters and reactive kVAh meters in the circuits to be measured are so equipped that the sum of readings of two or more instruments is obtained on a separate summator equipment. The kW and reactive kVA demands are obtained from these summators.

Three separate summators are required, both for kW and reactive kVA demand measurements. The first summates the import on the circuits connecting the supply authority to the Board's transmission system. The second summates the readings of integrating instruments on the generator circuits. The third set of summators adds to, or subtracts from, the summated generator output the import to, or export from, the Board's transmission system, and thus enables the total requirements of the supply authority in kW and reactive kVA demand to be computed.

It is necessary to know at what time the maximum loads occur, because the power factor can only be obtained by computation from the reactive kVA demand at the time of the maximum kW demand. Therefore, chart recording or printing devices are fitted to each summator to give a record of the units summated during each half-hourly period.

Each summator is provided with its own timing device for resetting the gear at half-hourly intervals and a master clock is provided at each station to ensure that the resetting occurs simultaneously on all the summators in the station.

All integrating instruments will be duplicated, and, in addition, provision is made for periodic checking of integrating meters by means of portable standards. The accuracy of the summators can be checked at any time by comparing their kWh readings with those of the integrating meters which operate them, and the summators are therefore not duplicated.

Control.—The grid system is divided into eight or nine areas, each under the control of an "Area Control Engineer," who is responsible for the plant in operation at each selected station in his area and for the general connections of the system under his control. To indicate the conditions obtaining at each transforming station and selected power station, a supervisory indication scheme is used employing telephone pairs, hired from the General Post Office and forming part of the public telephone system. A single telephone pair connects each transforming station to a control room situated centrally in each area and the following communications are transmitted automatically to the control room:—

(1) Indication of the position of each 132-kV circuit breaker.
(2) The voltage of the 132-kV busbars at each transforming station.
(3) The transformation ratio in use at each station.
(4) The power flowing through the transformers at each station.
(5) The reactive kVA flowing through the transformers at each station.

The control engineer is also able to transmit a general signal to all stations to "stand by." Each generating station is also in direct telephone communication wth the control room through the same pair of wires as is employed for supervisory indication.

In the control room is a system diagram, adjustable by hand, to suit varying arrangements and showing the complete connections of the system in the area.

* Elec. Rev., August 30th, 1929, p. 375.

Legal.

Edison Accumulators, Ltd., v. New Distributors of Edison Storage Batteries, Ltd.

In the Vacation Court, on October 2nd, Mr. Justice Macnaghten heard a motion by Edison Accumulators, Ltd., for a writ of sequestration of the property of New Distributors of Edison Storage Batteries, Ltd., for an alleged breach of an order made by Mr. Justice Clauson last July restraining the defendants from carrying on business in the name of Edison Storage Batteries, Ltd., or any name so resembling that of the plaintiffs as to cause confusion between the two companies.

Mr. Croom Johnson, K.C., for the plaintiffs, stated that in compliance with the order the defendants changed their name to "New Distributors of Edison Storage Batteries, Ltd.," but it was now complained that in breach of the injunction they had advertised their goods at the Shipping, Engineering and Machinery Exhibition, Olympia, under the name "Edison Storage Batteries" without the word "Ltd.," but with the addition of their address.

Mr. Bray, for the defendants, said that what happened was done without their knowledge or approval. The exhibition authorities, in accordance with the usual custom, asked for their name and address to put over their stall, but were told that this could not be done as litigation was then pending over the name. Mr. Perrin, the exhibition manager, said that in that case they would put up words on a board at the back of the stand indicating the goods to be sold, "Edison Storage Batteries," and without defendants' knowledge added their address.

Mr. Croom Johnson stated that after the motion was launched the address of the defendants was removed from the advertisement, and the exhibition having now come to an end, he did not ask for sequestration, but did ask for costs.

Mr. Bray contended that the plaintiffs were not entitled to costs, as there had been no wilful disobedience of the order.

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The defendants did not put up the advertisement, and had no control over the exhibition authorities.

Mr. Justice Macnaghten said that in his view there had been a clear breach of the injunction, but as the address had been removed and the exhibition had come to an end, he would make no order on the motion except that the defendants pay the costs.

Leave to appeal was given.

Case Against the S.W. & S. Power Co. Dismissed.

At the Oldbury Police Court, on October 1st, the Shropshire, Worcestershire and Staffordshire Electric Power Company was summoned by the Director of Public Prosecutions for an alleged breach of Regulation 18 (*d*) under the Factories Act, relating to electrical sub-stations. The case arose out of a fatal accident in the McKean Road sub-station, Oldbury, on July 4th. A fully-competent electrician with his mate was instructed to remove from a block of steel-clad switchgear a spare cubicle containing the incoming switchgear operating at 5,500 V. Before commencing the work the electrician tripped the oil switch and drew the isolating links, thus making "dead" the middle and upper sections of the incoming cubicle, and also the whole of the spare cubicle. The incoming cable remained "alive," but the bottom section, enclosing the terminals of this cable was made safe by a screwed-on steel cover. After the spare cubicle had been unbolted, the electrician unscrewed the back plate of the middle section of the incoming cubicle, and also took off the protective plate of the bottom section of that cubicle for inspection. He then noticed a lamp wire in the middle section of the cubicle which connected with the detached spare cubicle, and, omitting to replace the plate on the bottom section containing the terminals of the incoming cables, proceeded to remove the lamp wire from the middle section. In so doing his knee came into contact with the terminals and he was killed.

The case for the prosecution was that no work should have been done on the switchboard without first making "dead" the whole of it, including the incoming cables, and that there was no independent provision for making "dead" those cables except by disconnecting the whole of the cable at the Oldbury Road sub-station some distance away, thus disconnecting also a number of consumers *en route*.

The company contended that the case fell within Regulation 18 (*d*) (ii), and that as the switchboard was built in sections and each section could be made "dead" independently, and as it was not necessary actually to do any work in the "live" section, there had been no breach of the Regulations.

The magistrates agreed that the switchboard was built in sections and came within Regulation 18 (*d*) (ii), and that no work had to be done in the "live" section. The case was accordingly dismissed.

Summons Against Chesterfield Corporation Dismissed.

The *Yorkshire Post* reports that the Chesterfield Corporation was summoned at the local Police Court on October 3rd for failing to make dead a switchboard during the removal of temporary hoisting equipment, and for working conductors dangerously and not having them protected.

Mr. G. J. Ball, for the Director of Public Prosecution, said that a workman named Shelley was removing a scaffold pole when his foot slipped on the unlashed end of the pole, causing him to fall 10 ft. on to a live bar charged at 33,000 volts. It was submitted that before the man was allowed to tackle the job the whole of the switchboard and conductors should have been made dead.

Mr. J. F. Peaker, deputy electricity manager, said that he and Shelley made dead all apparatus but a bar behind the switchboard. Witness reminded Shelley that the bar was alive, and the man answered, "All right." Mr. N. Winning (for the Corporation) said it was never intended that Shelley should be nearer than 4 ft. 6 in. to the live bar, and had he not put his foot on the loose pole it would have been impossible for him to touch the bar. He submitted that there was no negligence.

The magistrates dismissed the three summonses; and when Mr. Ball asked for a case to be stated, the chairman (Mr. D. N. Turner) declined, stating that the case rested purely on a question of fact.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

A New One-piece Industrial Reflector.

A new improved type of "Philips NR" industrial reflector (fig. 1) has recently been introduced by Philips Lamps, Ltd., Philips House, 145, Charing Cross Road, W.C.2. The outstanding feature of this apparatus is that it is stamped from one piece of heavy-gauge metal, with an entire absence of welded or other joints. The angle of the cut-off is in accordance with

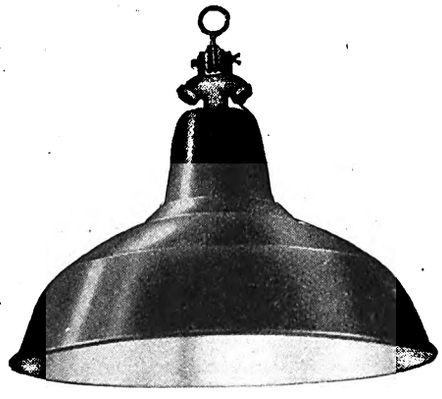

Fig. 1.—New "Philips NR" Industrial Reflector.

Home Office recommendations. The fittings are made in five sizes, ranging from 10 in. to 18 in. in diameter, and can be supplied with hook suspensions or screwed bushes (⅝ in. and ¾ in. conduit thread or ½ in. gas). The 10 in., 12 in., and 14 in. sizes can, in addition, be supplied with 1⅛ in. holes. The reflectors are manufactured from vitreous-enamelled heavy-sheet steel, white inside and black outside, and the workmanship is of the highest standard throughout.

A Bakelite Pocket Lamp.

We have received from the Runbaken Magneto Co., Tipping Street, Ardwick, Manchester, a sample of the "Everbrite" pocket lamp which it has recently produced, and for which the General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, is the sole selling agent for the electrical trade. The pocket lamp is of robust construction, and all parts are interchangeable. It has a moulded bakelite case of handsome appearance, in black or brown finish. It is equipped with a 5-plate unspillable battery, which will give 9 to 10 hours' continuous light. The metal parts are lead-plated to prevent corrosion. A chart for registering the date of the last charge is contained on the inside of the cover. The standard model is fitted with a charging device, which enables the battery to be charged without removing it from the case. The outfit includes a spare bulb and clip. The weight complete is 8½ oz. The pocket lamp is guaranteed for five years. A focussing attachment can be supplied for an extra charge.

Home Office Pattern Propeller Fans.

The knowledge that the present neglect of the Home Office Regulations, regarding the type of extractor fans that are used for the removal of fumes of a highly inflammable and explosive nature will not be permitted in the future, has prompted Messrs. S. G. Leach & Co., Ltd., (associated with Messrs. M. W. Woods, Ltd.), 26-30, Artillery Lane, E.1, closely to examine the difficulties that had to be overcome to satisfy the Home Office requirements. It was immediately apparent that the motor driving the fan impeller should be of a flame-proof design, and a close study of the Home Office requirements has resulted in the "Leach-Woods" Home Office pattern propeller fan (fig. 2). The motor, for use on both a.c. and d.c., is a totally enclosed, continuously rated motor, complying with the B.E.S.A. Specification. The end covers of the motor are of special design, so arranged that in the event of an explosion occurring, by the time the ignited gas has reached the outside atmosphere, owing to the large machined surfaces of the covers, the temperature would be sufficiently reduced to prevent any fear of further ignition. The terminal box, which is cast in an integral part of the back end cover, is designed on the same principle, and fitted with a heavy machined lid securely fixed by four hexagonal screws.

A point that has also received careful attention is the design of the impeller or blade end bearing. In addition to the ordinary ball bearing, which is fitted to take radial and end

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thrust, a special grease stuffing gland has been introduced to prevent the possibility of any inward leakage of the outside atmosphere. The 4-way heavy duty "Leach-Woods" propeller blade, is, owing to its special design, eminently more suitable for use on air extraction, this being due, not only to the much larger volume of air that it will move, and hence higher velocity, an important point where the fan is dealing with fumes having a very much greater density than normal air has, but also to the fact that it is capable of satisfactorily working against the relatively high resistance which may be set up by duct work.

The range of sizes for these fans has been limited to 12, 15, 18, 24, and 30 in., but the designs for larger fans up to and

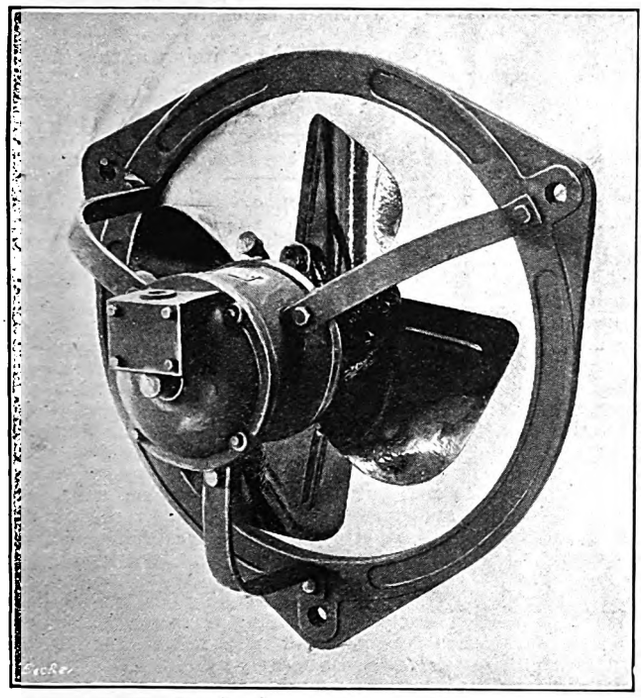

Fig. 2.—"Leach-Woods" H.O. Propeller Fan.

including 60 in. size, these latter in particular for working against resistances up to about 1½ in. water gauge, are being proceeded with. The fans are British made throughout at the Colchester Works.

A New Insulating Material.

"Mycalex," a new electrical insulating medium, is claimed to represent what is probably the most revolutionary advance in applied electro-chemistry since the introduction of synthetic resins. It is a vitreous product composed of pure electrical mica (or other base), intimately associated with a vitreous flux resulting essentially in a new medium (not merely a new material), which is perfectly stable and inert under all conditions likely to be met with in service. It can be produced in sheets, rods, or tubes. It can be extruded into any section, and moulded in conjunction with metal inserts. The finished product, although of the consistency of porcelain, can be drilled, tapped, sawn, or machined in the lathe, and its mechanical strength surpasses that of any other insulating material. "Mycalex" is essentially a British product, but hitherto it has been manufactured in America and Germany under licence from the patentees. Now, however, it is to be produced in England, under the personal supervision of the inventor, Mr. P. B. Crossley, F.I.C., M.I.Chem.E., who has designed the special plant for that purpose. The works are at Harlesden, near Willesden, Middlesex, and the registered offices of the Mycalex (Parent) Co., Ltd., are at Abbey House, Westminster, where specimens can be seen by those interested. Noteworthy amongst these specimens is the model high-tension stator-bar with the insulation moulded on, in intimate contact with the metal, leaving no air-spaces. The new material can also be made in different grades to suit requirements, ranging from the ordinary grade, which is refractory at 450° C., up to a special arc-resisting quality of an alternative base composition. It can be produced in a variety of colours and with glazed surfaces. The dielectric losses compare favourably with high-grade ebonite, so that insulating medium has an enormous field of application in high-frequency work, either for panels (where its high mechanical strength enables the thickness to be appreciably reduced) or for strain insulators, where the material is either in tension or compression.

An Automatic Scaling Machine for Electric Welding.

In our issue of September 6th, under the above heading, we described an automatic scaling machine introduced by the Westminster Engineering Co., Ltd., Victoria Road, Willesden Junction, N.W.10. It should have been mentioned that the machine is patented in this country, and that applications have been made for foreign patents.

A Smoke Abatement Conference.

Report of the Proceedings at Buxton.

THIS year's smoke abatement conference, which was held at Buxton (October 4th to 6th) was of peculiar interest, for it marked the merging of the Smoke Abatement League of Great Britain and the Coal Smoke Abatement Society into a new association for which the title of the National Smoke Abatement Society was unanimously chosen. The proceedings at Buxton, whilst being to a large extent concerned with the domestic arrangements of the new Society, of which Dr. H. A. Des Voeux was chosen president, were also marked by the delivery of two very interesting papers, one dealing with the industrial uses of gas and one with the industrial uses of electricity. The gas address was prepared by Mr. S. Tagg, manager of the Preston Gas Co.; whilst interesting, and in certain respects convincing, it was not such a complete summary of the position as was that given on behalf of the electrical industry by Mr. Verdon Cutts, of the General Electric Co., Ltd., who very wisely devoted his attention to the particular subject in which he is expert, *viz.*, the application of electric heat to industry. He said that thus far its development and application had been the work of the pioneer and the enthusiast, and consequently the details and incidents of such development had not been so generally known as would probably have been the case if more people had been engaged on the work. Industrial heating by electricity had definitely arrived, and no power on earth could arrest its progress. To the central station engineer it was of vital importance, because it represented a load-building factor of considerable magnitude. It was of equally vital importance to the electrical manufacturer, since that which created a demand for electrical energy must also call for plant and equipment. To-day's tendency towards improved methods and equipment to ensure better production at competitive manufacturing costs had created a demand for the precision and efficiency which electric heating rendered possible. A degree of exactitude which had hitherto been regarded as commercially impossible was now attainable on a production basis under ordinary shop conditions, thus facilitating scientific management. Mr. Cutts then went on to say that in many cases and for many purposes the electric furnace, or oven, was capable of competing with fuel-fired furnaces on a straight cost basis. Even where that was not possible there was a considerable field in which the value of the inherent advantages of electric heating fully justified its use. Whilst recognising those favourable facts, it could not be denied that there were other purposes and circumstances for which and in which electric heating could not at present compete with fuel-fired furnaces and ovens. In fact, he would go further and state that those who were genuinely interested in the development of industrial electric heating should definitely discourage any projected application which was not certain of success from an economic point of view, even though technically it might be quite feasible and practicable. Mr. Cutts described in general terms and in a most convincing manner the wide range of application and the inherent characteristics of electric heat, affirming that the electric furnace and oven represented an important contribution to the subject of smoke abatement. He devoted the closing portion of his discourse to a brief reference to a few specific applications of electric heat to industrial processes. He turned to the steel industry, and to the audience this was particularly interesting, for the previous speaker had, presumably by mere coincidence, devoted a section of his address to the subject of gas heating in the steel industry. The first application of electric heating to that industry, said Mr. Cutts, was for melting and steel making. Now the use of electric melting furnaces in the steel industry was confined almost exclusively to the melting of scrap, the refining of Bessemer, or open hearth, steel, and to the production of special alloy steels. Regarding the matter primarily from the smoke abatement point of view, the most important field for the electric furnace in that industry was that of heat treatment. Probably no branch of metallurgy had advanced so rapidly as the heat treatment of steel. The electric furnace was asserting itself forthat work, because it was vital that the temperatures to which steel was heated should be determined with the greatest possible precision consistent with works practice and shop conditions. Especially was that true of alloy steels, to illustrate which he referred to an incident within his experience. A firm having a large and important trade in carbon steels with the United States found it necessary to hold heavy stocks of certain sizes ready for immediate dispatch. When the Fordney tariff came into force those stocks were thrown on to their hands. A market was ultimately found for that steel and the first 20 tons delivered, but it failed miserably, with consequent disappointment to all concerned. Some few months later a further batch of the same steel was heat treated in an electric furnace and sent to the same works which had rejected the first lot. The report was that it was a different steel altogether and that it suited their purpose admirably. The difference was that the first lot had been indifferently heat-treated in a fuel-fired furnace, which was incapable of the necessary uniform and precise temperature control, whilst the second batch had been heat-treated

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with precision and the desired physical properties been developed and fixed.

In annealing, hardening, tempering, normalising, case-hardening, and the general heat treatment of steels there was a definite field for the electric furnace. In recent years there had also been marked development in special steels, such as those of the stainless variety, which at various stages required heating under conditions which precluded the possibility of their being licked by flame or coming into contact with any products of combustion.

In the non-ferrous trades the electric furnace was being used for the melting of brass, copper, zinc, aluminium, gold, silver, &c., with conspicuous results. The considerable reduction in melting losses which the electric furnace rendered possible not only made for economy, but also enabled alloys of precise analysis to be produced with ease. In the annealing and normalising of those metals and alloys similar considerations apply to those already referred to. In some cases the temperature margin was so very slight as to call for electric heating even when the cost of the electrical energy exceeded that of other fuel. For the refining of aluminium the electric furnace was ideal from a metallurgical point of view, working with a perfectly quiescent bath in an atmosphere free from gases.

Electric core-drying stoves were growing in number, although at the present time they are being chiefly used for small cores. Another interesting application of growing importance was the vitreous enamelling of metals. With the advent of the electric furnace that ancient art had developed into a modern industry of no mean size. The upkeep cost of an electric enamelling furnace was low and a very important point was cleanliness; the sulphur fumes and other products of combustion in fuel-fired furnaces caused contamination which was definitely detrimental. The reason why electric furnaces were being adopted more generally for such work was because many manufacturers had found that they got a better product under better working conditions; also a reliable rate of manufacture, free from interruptions. It was a significant fact that in a large number of cases in which electric furnaces were being used for that purpose, the cost of energy consumption was actually greater than the corresponding cost of fuel, but the incidental and consequential savings were so considerable as greatly to outweigh that initial disadvantage.

The baking of japan, paint, varnish, lacquer, &c., was a purpose for which the electrically-heated oven was ideally suited. As a rule it gave an excellent finish, was clean and safe, and lent itself admirably to automatic control.

For sherardising, electric furnaces with automatic control were suitable and there were now several electric galvanising installations in successful operation, in which electricity was used for heating the zinc tanks. The annealing of glass was a duty which called for just those features which were characteristic of the electric furnace. Accurate adjustment of temperature and even application of heat were prime essentials in that work. Shallow temperature gradients were required. The ease with which electric heat could be controlled automatically was a great advantage, as it eliminated, or minimised, labour requirements in a process which extended over long periods of time. The electric furnace was also a clean proposition, as the ware did not absorb products of combustion and was free from sulphurage. Rejects due to breakage or distortion were practically eliminated. Electric furnaces were being applied to many other specialised trades, including ceramic work, china firing, decorating high-grade china, the firing of stained glass, &c., as well as for assay, test, and other purposes.

At a general meeting of members of the new National Smoke Abatement Society held on October 6th the new constitution was fully considered. The objects of the Society are clearly defined as (1) to create an informed public opinion on the evils of air pollution; (2) to inquire into, and, if thought advisable assist, investigations directed towards the abolition of smoke, whether industrial or domestic; (3) to take steps to popularise the use of smokeless methods of heat and power production; and (4) to promote and support legislation for preventing the pollution of the atmosphere.

It would appear that the work of the Society is deserving of greater support on the part of the electrical industry than it has in the past received.

Correspondence.

Correspondents should forward their communications* as early as possible.** ***No letter can be published unless we have the writer's name and address in our possession.

Unappreciated Economies of High Voltages.

Certain comments which I have received relating to the article of mine which appeared in your issue of September 13th would make it appear that I did not sufficiently emphasise that the deductions in that article applied with even greater force if the change in voltage were from 5,500 volts to 22,000 volts than if the change were made from 33,000 volts to 132,000 volts.

Any lack of emphasis which my article possessed on this point was perhaps a little further exaggerated by your leaderette, which was labelled "132 kV Cables"—thus giving the impression that *only* 132 kV cables were in question.

Consequently, there is a danger of engineers who still possess 5,000-volt sub-stations not realising that, so far from there being nothing of interest to them in a change of voltage, *they have even more to gain* in changing to, say, 33,000 volts than has a system in which the change is made merely from 33,000 volts to 132,000 volts.

In fact, where equal quantities of power transmitted are at stake, the annual saving by changing over from 5,000 volts to 33,000 volts is of the order of *no less than, say, 5-6 times* that obtained in a change-over from 33,000 volts to 132,000 volts.

Similar (but not equal) benefits would apply to those systems which now employ 11,000 volts at sub-stations, if they raised this to 66,000 volts.

Trusting that this point may not be entirely without interest to many of your readers.

A. M. Taylor,
Major, S.O.2.

Birmingham, *October 3rd*, 1929.

Domestic Wireless.

May I be allowed a little space to reply to Mr. F. Boysen and Mr. G. E. Moore?

Mr. Boysen's "failure to see" may be due to the too frequent use of a.c. for reading illumination, as I have already indicated. If he will try a few simple stroboscopic experiments by a.c., I think he will be convinced.

I do not think I can be accused of prejudice against "eliminators" as such, since the first rectifier shown at the Institution of Electrical Engineers in 1923 was of my manufacture, but I still maintain that claims made for their use are unnecessary and unjustifiable in many cases.

Mr. Moore is even more severe. He accuses me of "antipathies" to a.c., but I must deny such an attitude as both unscientific and unreasonable. If, however, he extends his accusation of antipathy to the use of a.c. for domestic and general purposes he is correct, and I should be a humbug to conceal it.

Alternating current has one outstanding and unassailable property: that of easily transforming pressures for distant energy transmission generally, otherwise it is a crude, make-shift current, justifiable almost entirely by commercial expediency, that is, cheapness.

For traction, small motors, illumination by filament, arc, or vapour (including cinema projection), physiologically, for telegraph or telephone use, for electro-chemical purposes (including deposition and secondary cell charging) a.c. is inferior to continuous current, and peevishness will not alter even "technical facts."

It should be incumbent on suppliers of current to install convertors to continuous current to all communities exceeding 100 consumers.

I should hate to spoil Mr. Moore's Utopian "pictures of the future," but should like to point out that achievement is generally attained by those who look not too far ahead of the present.

As I close the door, dare I ask Mr. Moore his opinion, in the light of "logic and trading," of the interest manifest quite recently in crystal sets?

A. Mortimer Codd.

Esher, *October 5th*, 1929

My Electric House.

I do not wish to prolong unduly the discussion on my recent article under the above heading, but I feel that the remarks of Mr. N. Williams in your issue of September 27th call for comment.

In the first place, I would point out that, realising that reliable information as to operating costs is scarce at present, my article was primarily intended as a description of my own domestic installation and the results obtained, with the hope that others would be encouraged to prepare similar reports, which would be useful for propaganda purposes. Mr. Williams, however, seems to have taken me to task as to whether the average householder can afford to spend £27 a year for current. Although this matter is really outside the scope of my article, the points he has raised are extremely interesting, and if it is not encroaching on your valuable space too much, I shall be pleased to deal with them.

He asks "how many people in this country can afford to pay £20 to £27 per year for current?" I submit that his contention that "only the highly paid people or those with some means" can afford this is entirely erroneous. £27 a year is 10/- a week, and, as you point out in your leaderette on this subject in your current issue, there are not many householders who can limit their total coal, gas, and electric light bills to this figure. It really comes to this: that the householder using electricity for all his services is presented with four comparatively large bills per year, instead of the numerous ones he would receive if he employed gas, coal, and electricity, which, although smaller individually, are in the aggregate quite as large, if not greater. Psychologically, no doubt, the effect on the recipient of the bills is greater in the former case than in the latter. The results published in your current issue concerning the consumptions of the cottages in the L.C.C. housing estate of the Barnes undertaking are

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another proof in this matter; also, the average running costs stated are well within the limit of £15 a year of Mr. Williams.

Mr. Williams is of the opinion that my installation must have "cost quite a lot of money." Personally, I do not think that there is anything particularly wonderful about it. Let us examine the list I gave in Table I in my article. Lighting of some form or another has to be provided in all houses, so this can be neglected. I would point out right away that I did not obtain all this equipment at the same time. According to the state of the exchequer, this was added piece by piece over a period of three or four years. The wiring for the power and heating points was carried out by myself, additional points being installed from time to time as required. The cooker and one kettle were obtained on hire from the supply undertaking. The majority of the consumption is accounted for by the cooker, radiators, and water heater. The remainder of the equipment costs very little to run, but adds considerably to the comfort and convenience of the household. If one systematically purchases various domestic appliances from time to time as opportunity presents itself, it is surprising the number of handy little gadgets one finds in one's possession after a few years.

I think that Mr. Williams is more than a little unfair to me when he suggests that I have "given no thought to the poorer classes who require greater assistance to be able to enjoy these things." Personally, I should like to see every home in the land electrically equipped. But, like every other innovation, this is popularised *downwards* through the ranks of society. Gas lighting, for example, at one time was the province only of the very rich, but nowadays it is usually within the reach of the poorest in our towns and cities. Therefore, in my opinion, it is incumbent on gentlemen like Mr. Williams and myself to equip our homes electrically as extensively as possible, in order that the benefits and advantages of "the little world," in which I am accused of living in splendid isolation, may be extended to those less fortunately placed. I would say, in conclusion, that my own experience, in dealing with the requirements of domestic consumers of the undertaking with which I am connected, indicates that this "little world" has already become a fair sized planet and is still rapidly growing.

Reg. H. Rawll.

Birmingham, *October 6th*, 1929.

British Industries Fair, Birmingham.

The Fair authorities are very anxious to introduce into the Fair anything which will tend to promote smooth working and assist visitors.

There appears to be a demand for some method of signalling throughout the Fair to enable, *e.g.*, the chairman, secretary or other, officials to be found and to convey other messages throughout the building. I understand that the number of different messages that it is desired to transmit is between 10 and 20, and the Fair authorities have asked if we can suggest some method of conveying such signals.

I shall be glad to hear from any firms or individuals who would like to suggest methods of dealing with the problem which I have indicated.

W. A. Vignoles,
Director and Secretary,
Electrical Development Association.

London, *October 7th*, 1929.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1928.

7,017. "Telegraph systems." A. H. Marks and P. Russell (legal representatives of E. C. R. Marks, deceased) (Western Union Telegraph Co.). March 6th, 1928. (318,841.)

10,084. "Arrangement in asynchronous machines with commutator machines mounted in cascade." Siemens-Schuckertwerke Akt. Ges. April 14th, 1927. (288,630.)

11,199. "Alternating-current commutator motors." British Thomson-Houston Co., Ltd. April 16th, 1927. (288,987.)

13,207. "Electric luminous signs and signalling apparatus and their controllers." J. P. Naylor. May 4th, 1928. (318,903.)

13,508. "Means for varying the temperature coefficients of induction-measuring instruments." Landis & Gyr Soc. Anon. September 9th, 1927. 296,774.)

14,188. "Telegraph systems." W. E. Beatty (Bell Telephone Laboratories, Inc.). May 14th, 1928. (319,032.)

14,276. "Electrolytic condensers." A. E. White (Fansteel Products Co., Inc.). May 15th, 1928. (319,033.)

16,345. "Sparking plugs." Graflich Schaffgotsche'sche Werke Ges. June 4th, 1927. (291,724.)

16,386. "Synchronisation of machines for recording sounds and movements." C. H. Verity. June 5th, 1928. (Cognate applications 21,249/28, 23,251/28, and 30,476/28.) (318,847.)

16,732. "Electrostatic loud-speakers and the like." E. Reisz. June 8th, 1928. (318,876.)

16,741. "Carrier frequency signalling systems." Elect ical Research Products, Inc. June 11th, 1927. (292,077.)

16,812. "Means for tuning radio-sets." H. N. Marvin. June 9th, 1928. (319,037.)

17,100. "Automatic and semi-automatic telephone exchange systems." Standard Telephones & Cables, Ltd. (G. Deakin). June 13th, 1928. (318,944.)

17,101. "Automatic and semi-automatic exchange systems." Standard Telephones & Cables, Ltd. (G. Deakin and L. Polinknowsky). June 13th, 1928. (318,945.)

17,103. "Signalling systems." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). June 13th, 1928. (318,946.)

17,104. "Electric resistance units." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). June 13th, 1928. (318,947.)

17,121. "Electromagnetic devices." A. Wright. June 13th, 1928. (Addition to 291,494.) (318,950.)

17,151. "Synchronising systems for use in television systems." Electrical Research Products, Inc. June 23rd, 1927. (292,597.)

17,157. "Magnet cores." Automatic Telephone Manufacturing Co., Ltd., and P. N. Roseby. June 13th, 1928. (318,953.)

17,174. "Electrolytic cells." Montecatini Soc. Générale per l'Industria Mineraria ed Agricola. June 14th, 1927. (292,130.)

17,231. "Switching mechanism for automatic or semi-automatic telephone systems." Standard Telephones & Cables, Ltd. (L. J. J. Schreiber). June 14th, 1928. (319,046.)

17,357. "Dials or the like for electrical condensers or other electrical instruments." C. F. Burton and H. Burton. June 15th, 1928. (319,051.)

17,438. "Aerial systems." Standard Telephones & Cables, Ltd. (Bell Telephone Laboratories, Inc.). June 15th, 1928. (319,055.)

17,459. "Electrical plug-and-socket connections." J. B. Tucker. June 16th, 1928. (Cognate application 1,507/29.) (319,058.)

17,506. "Iron-cored inductances." Radio Instruments, Ltd., and W. L. Shaw. June 16th, 1928. (319,061.)

17,519. "Maintenance of constant frequency in high-frequency electric circuits." C. Lorenz Akt. Ges. June 24th 1927. (292,600.)

17,710. "Control of electric motor-generator sets." British Thomson-Houston Co., Ltd., and R. D. Parry. June 19th, 1928. (319,072.)

17,715. "Electric terminals." General Electric Co., Ltd., and R. J. Kaula. June 19th, 1928. (319,074.)

18,387. "Amplifiers of sound-reproducing instruments." J. Durham. June 25th, 1928. (319,080.)

18,804. "Sound transmitter." W. L. Walker. June 28th, 1928. (319,084.)

18,876 "Coin-freed mechanism, particularly applicable to prepayment devices for use with electric meters." C. E. Fry. June 29th, 1928. (319,085.)

19,282. "Massaging machine with electromagnetic engines." N. E. Goodrich. July 3rd, 1928. (319,088.)

20,549. "Electric lampholders." R. Nettl. July 16th, 1928. (319,095.)

20,778. "Sparking plugs." Graflich Schaffgotsch'Sche Werke Ges. July 29th, 1927. (Divided application on 291,724.) (Addition to 291,724.) (294,649.)

21,030. "Portable wireless receiving apparatus." P. D. Tyers. July 19th, 1928. (319,100.)

23,531. "Television apparatus." L. Tschorner. August 15th, 1928. (319,115.)

23,540 "Induction motors." Siemens-Schuckertwerke Akt. Ges. November 3rd, 1927. (299,865.)

23,889. "Stringed loud-speaker." C. Midhat. August 20th, 1928. (319,118.)

23,944. "Means for automatically controlling an electromagnetic device." E Quartier. August 20th, 1928. (319,120.)

24,075. "Electromechanical vibrating devices for use, for example, in loud-speakers." M. Trouton and Wireless Music, Ltd. August 21st, 1928. (319,121.)

24,433. "Newspaper conveyors." Igranic Electric Co., Ltd., A. H. Curtis, A. H. Mackley and H. H. Rapley. August 24th, 1928. (319,123.)

25,863. "Poles, masts, and the like for supporting overhead electric wires and for similar purposes." A. H. Seabrook and A. Avis. September 8th, 1928. (319,133.)

26,735. "Impulse senders of the finger-disc type." Telefonaktiebolaget L.M. Ericsson. September 20th, 1927. (297,388.)

27,198. "Wireless receiving apparatus." A. E. Bowyer-Lowe. September 21st, 1928. (319,141.)

27,938. "Thermionic valves." Marconi's Wireless Telegraph Co., Ltd. September 29th, 1927. (297,847.)

28,411. "System and apparatus for producing or reproducing sound." G. R. H. Caine and H. Scott-Dennington. October 8th, 1927. (298,475.)

28,455. "Method of and apparatus for the electrolytic revivification of ferrocyanide of potassium formed in the purification of gases by oxidation of hydrogen sulphide with ferrocyanide of potassium." R. Brandt. October 4th, 1928. (319,147.)

28,543. "Timepiece with electric driving mechanism." E. Beck. October 5th, 1927. (298,202.)

28,663. "Electromagnetic relays with two armatures. Siemens & Halske Akt. Ges. October 6th, 1927. (298,241.)

28,908. "Protecting device for current-distributing plants." Rheinisch-Westfalisches Elektrizitatswerk Akt. Ges. October 7th, 1927. (298,490.)

31,864. "Apparatus for amplifying and/or rectifying oscillations." Telefunken Ges. fur Drahtlose Telegraphie. November 5th, 1927. (300,124.)

36,724. "Electrical control devices." Associated Electrical Industries, Ltd. December 13th, 1927. (302,286.)

36,841. "Construction of transformers, choking-coils, and other parts of wireless apparatus to facilitate assemblage." J. Feldman. December 13th, 1928. (319,167.)

37,247. "Electron-discharge devices." British Thomson-Houston Co., Ltd. December 22nd, 1927. (302,908.)

38,043. "Combined table-lamp and loud-speaker." E. F. Schafer. December 24th, 1928. (319,175.)

1929.

2,924. "Power supply apparatus suitable for use in supplying thermionic valves and the like." Siemens & Halske Akt. Ges. January 27th, 1928. (305,049.)

4,473. "Tramway points." H. Grengel Weichenbau Ges. February 10th, 1928. (305,935.)

7,970. "Automatic and semi-automatic exchange systems." Standard Telephones & Cables, Ltd. (G. Deakin and L. Polinkowsky). June 13th, 1928. (Divided application on 318,945.) (318,956.)

7,971. "Automatic and semi-automatic exchange systems." Standard Telephones & Cables, Ltd. (G. Deakin and L. Polinkowsky). June 13th, 1928. (Divided application on 318,945.) (318,957.)

7,972. "Automatic and semi-automatic exchange systems." Standard Telephones & Cables, Ltd. (G. Deakin and L. Polinkowsky). June 13th, 1928. (Divided application on 318,945.) (319,063.)

9,348. "Control mechanism for centrifugal compressors." British Thomson-Houston Co., Ltd. March 22nd, 1928. (308,369.)

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from the dates mentioned :—

SEPTEMBER 25th.

Chromalox. No. 505,441. Class 8. Electrical resistances.—Geo. Bray and Co., Ltd, Bagby Works, Leicester Place, Leeds.

OCTOBER 2nd.

Turnlight (lettering and design). No. 493,287. Class 8. Electric batteries (not for medical purposes).—Die Batterien & Elemente Fabrik System Zeiler Gesellschaft, 20, Rungestrasse, Berlin, S.O.16, Germany. (British representatives: Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

Jumbo (lettering only). Nos. 502,066 and 502,597 (word and design). Class 8. Wireless telephonic and telegraphic apparatus and parts thereof, &c. —The Parlophone Co., Ltd., 1, Broad Street Place, E.C.2.

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERDEEN.—Reconstruction and extension of harbour (£250,000); R. Gordon Nicol, Harbour engineer.

ACCRINGTON.—Housing scheme (114); borough surveyor.

ADDISCOMBE.—Houses (50), Hillcote Avenue and Gibson's Hill; H. Macintosh.

ARBROATH.—Additions, including electric cranes, for James Keith & Blackman Co., Ltd., engineers; Gordon and Scrymgeour, architects, Dundee.

AYR.—Rebuilding of Ayr Playhouse; George Green, picture house proprietors, Glasgow.

BERWICKSHIRE.—Schools, Chirnside and Eyemouth; clerk, Education Authority, Berwick.

BEXHILL.—Houses (40), Sidley estate; Tree & Castle, Ramsgate. Houses, Barnhorn Road, Cooden Drive, and Terminus Avenue; J. E. Maynard.

BILLINGHAM.—Housing scheme (88), for the U.D.C.; surveyor.

BOLTON.—Estate development, off Ellesmere Road; Sir W. B. Hulton. Development, Lord Bradford's estate, off Manchester Road; George Henderson, agent. Senior school (720 places), Whitecroft Road, for the E.C. Additions, Theatre Royal, Churchgate; Bolton Theatre and Entertainments Co., Ltd. Additions, Runworth Cinema, St. Helens Road; Bolton Cinema Co., Ltd.

CHURCH GRESLEY (Swadlincote).—Re-erection of works, for Mansfield Bros.

CRANLEIGH (Surrey).—Public hall (£4,600), with heating and lighting, for the Parish Council; Mr. Wade, architect.

CROYDON.—Houses (500) and shops, Woodvale estate; Central Estates Co., Ltd., Kenton, Harrow. Shops (11) and houses, Zermatt Road; A. Andrews. Two villas for 100 patients at mental hospital; J. M. Sheppard. Elementary school, Lodge Road (£28,620); J. R. Gray, Coventry.

DARWEN.—Baths (£36,000); borough surveyor.

DEAL.—Electric lighting installation, Town Hall, for the T.C.; borough surveyor.

DUMFRIES.—Warehouse, shops and offices, with electrical work; J. & J. Hall, architects, Landhope Vale, Galashiels.

EDINBURGH.—Houses (250), for the Corporation; city architect.

GREENOCK.—Depôt and offices, for Anglo-American Oil Co.; the manager.

GRIMSBY.—Conversion of Manor House, Brighowgate, to hotel; C. W. Dixon, builder.

HASLINGDEN.—Sewage disposal works (£50,000), for Haslingden, Rawtenstall and Bacup Outfall Sewage Board.

HOUNSLOW.—Houses (56), Whitton Park estate; P. Chase Gardener & Co., architects.

HULL.—Laboratories, Alfred Gelder Street, for the city analyst (£8,244); D. Harvey, city architect.

INVERNESS.—Reconstruction and adaption of infirmary as nurses' home; the medical superintendent.

IRISH FREE STATE (Maynooth, Co. Kildare).—New wing, St. Patrick's College; Ashlin & Coleman, architects, 7, Dawson Street, Dublin (returnable deposit of £3 3s.).

(Maryborough, Queen's Co.).—Rewiring mental hospital, for the Committee of Management; Denis Heaney, borough engineer, Thurles, Co. Tipperary (returnable deposit of £5 5s.).

IRLAM.—Housing scheme (50); surveyor to U.D.C.

LEEDS.—Houses (40) and flats (24), Meanwood estate; W. Thompson & Sons. Houses (28) and flats (12), St. Albans estate, houses (60) and flats (24), Southfields estate; Paul Rhodes, Ltd. Clinic, Harehills Lane, for the E.C. Tenders to James Graham, director of education, by October 14th (deposit, £1 1s.).

KIRKINTILLOCH.—R.C. school (£48,000); clerk, Education Authority, Dumbarton.

LONDON (Ilford, E.).—Houses (500) and shops, Aldborough Grange estate; Suburban Developments (London), Ltd. Houses (173), Meadway, &c.; J. Aldridge. Development, Hedgemans Hall estate; Rawlins, Culver & Co. Central school, Bean site, for the E.C. Nurses' home, &c., Isolation Hospital (£11,000); borough engineer. Factories, Grove Road; W. G. Young (3), F. Smith (1), H. Chappel & Co., Ltd. (1).

(Barking, E.).—King George Hospital (£70,000), for the Committee; Roland Hill, chairman. Housing scheme (237) and flats (24), for the U.D.C.; surveyor. Extensions, Hart Lane; Cape Asbestos Co., Ltd. Extensions, West Bank; Russian Oil Products, Ltd.

(Beckenham, S.E.)—Junior schools, Witham Road, for the E.C.; J. R. Hambridge, secretary.

(Lewisham, S.E.).—Cinema, Downham Broadway, for Super Cinemas, Ltd.; Hammond & Barr, Ltd., builders, 52, Beauchamp Place, S.W.

(Bermondsey, S.E.).—Rehousing scheme, Grange Road; borough engineer.

LONGNIDDRY.—School (£11,359); master of works, East Lothian Education Authority, Haddington.

MAIDSTONE.—Housing scheme (159), Mote Park estate, for the T.C.; borough surveyor.

MANCHESTER.—Enlargement of Ducie Street Central School (£16,000); S. Hey, Director of Education Offices, Deansgate.

MANSFIELD WOODHOUSE (Notts.).—Theatre (£13,000), for J. Pollard, Mansfield; Bryan Dean, architect.

MEIR.—Schools (£29,000); Stoke-on-Trent E.C.

MERTON.—School, for Surrey E.C.; W. W. Finny, secretary, Kingston-on-Thames.

MITCHAM.—Schools (1,600 places), Mitcham Road district; Croydon E.C.

NORTH BERWICK.—Hall (500 seats), for Town Council; burgh surveyor.

NUNEATON.—Baths (£25,000); borough surveyor.

ROWLEY REGIS.—Hospital (£25,000); surveyor to U.D.C.

SEDGEFIELD.—Additional 200 houses, for the R.D.C.; surveyor.

SELSDON.—Houses (46), Selsdon Park Road; T. H. Jones.

SHEFFIELD.—Houses, Greenhill estate (260), Longley estate (147); city architect.

SHIPLEY.—Municipal offices; U.D.C. surveyor.

SITTINGBOURNE.—Extensions to hospital, for the Joint Hospital Board; Marshall Harvey, architect.

SMETHWICK.—Further 90 houses, Old Chapel estate; borough engineer. Cinema, Windmill Lane; Irving Bosco, "Ducia," Lordswood Road, Birmingham. Premises, Church Lane; Birmingham Co-operative Society, Ltd. Market extensions, Windmill Lane; Lloyds Estates and Markets, Ltd. Extensions, Dartmouth Road; Birmingham Aluminium Casting Co., Ltd. Extensions, Wills Street; Wilmot Breedon, Ltd.

SOUTHEND-ON-SEA.—Hospital; Adams, Holden & Pearson, architects, 9, Knightsbridge, Hyde Park Corner, S.W. (returnable deposit of £5 5s.).

STOKE-ON-TRENT.—Estate development, off London Road; E. Kinson. Extensions, North Staffs. Technical College, for the E.C. (£14,000).

STRETFORD.—Dance hall, 433-5, Chester Road; Mrs. Reed.

TWICKENHAM.—Houses (51) at Fifth and Sixth Cross Roads; White & Moyes.

WADDON.—Film factory, Waddon Mills; J. T. R. Wildman, 189, Regent Street, W.1.

WATFORD.—Re-erection of factory, Bushey Hall Road, for the Ellam Duplicating Co., Ltd.

WELLINGBOROUGH.—Housing scheme (98), Croyland estate, for the U.D.C.; surveyor.

WINSFORD.—Housing scheme (60), for the U.D.C.; Peter Heaton, surveyor (returnable deposit of £2 2s.).

WOLSTANTON.—Hospital Board of Guardians.

WOLVERHAMPTON.—Schools, Bushbury Hill, Parkfield and Bradmore; J. A. Warren, director of education.

WORKSOP.—Housing scheme, Carlton, for the R.D.C.

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The ELECTRICAL REVIEW

FOUNDED 1872

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[*Advertisement of W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, London, E.C.1.*]

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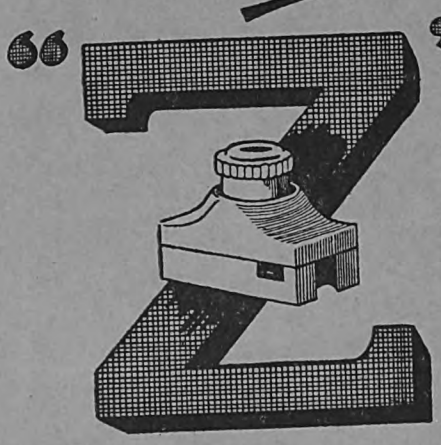

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The

Electrical Review

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Electrical Advance.

SOMEWHERE between thirty and forty years ago we had the privilege of listening to a popular and pioneering electrical lecture delivered by the late Prof. W. E. Ayrton, F.R.S., before a fashionable audience assembled at the Royal Institution of Great Britain, in the course of which he effectively demonstrated how easily the poor lone bachelor could electrically grill his own breakfast bacon.

That was about our first observation of a domestic application of electricity. Such things were in the experimental stage. Ayrton, with all the impressive bearing of one well-skilled in the conjurer's art, drew up his coat sleeves and made the little bit of fat frizzle out its forecast of the great future that electricity would have in the household. Wonderfully suggestive it all seemed at the time, and we remember how the "turn" went down amidst such measure of excitement, interest, and applause as greeted the mysterious performances at Maskelyne's popular house not far away.

This is but one little episode out of a thousand that have been recorded in the ELECTRICAL REVIEW, and the particular class of electrical apparatus shown in Albemarle Street has spread along so many ways of adaptation and application as to bring the cooking and heating sections of the electrical industry to their present wonderful proportions.

Handicaps in various forms have been met with on the way. Some of them have been real difficulties, but others have been the outcome of an apathy and a lack of faith amongst ourselves that should not have existed. Then there have been the deeply entrenched forces of gas cookers and fires whose competition we have been meeting all the time. But the handicaps and difficulties are being overcome as we make our way forward with

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a greater determination to meet the public requirements.

It may seem hardly credible that after all these years of design and experiment, argument, publicity, &c., there could be found man or woman uninformed with regard to the value of electricity in the home. But we are resting some part of our hopes in that direction upon the valuable work of the women's electrical organisations. Electrical women cannot help being a continuously growing force for domestic electrification.

This is the fourth annual domestic electrification number of the Electrical Review. The numerous encomiums that have been showered upon us for previous years' efforts in the same direction incline us to hope and believe that our readers and supporters everywhere will appreciate the present issue.

In many respects we have followed the same course as characterised our efforts of 1926, 1927, and 1928, but we have enlarged the size of the present number in order to enable us to increase the scope, and to-day we give it the title of "Domestic and Power Development." The additional subjects thus introduced into our autumn issue of 1929 are power plant, switchgear, &c., also rural developments, including overhead line construction work and industrial heating; each of these receives attention in leaderette comment below or in special contributions from some of the outstanding writers of the day.

Heavy Electrical Engineering Developments.

Since our last special issue (October 19th, 1928) several new works of outstanding importance have been put in hand, but not yet brought to completion, while we have begun to reap the advantage of others put into service before the period under review. Among the former may be cited the Mid-East England Scheme, which was published by the Central Electricity Board last March, making the fifth scheme to be adopted.

Among recent developments in the "heavy" section there has been some activity on the railways. Thus, the Southern Railway has this week decided to extend its electrified system by 68 miles, including 37 miles on the Brighton main line. The official opening of the Great Indian Peninsula railway has been arranged to take place—with regard to the first 86 miles—on November 5th, while a further 52 miles is expected to be available for traffic in the early future. The rapidity with which unattended sub-stations are finding favour, even where labour is cheap, is a sign of their reliability and net economy. The above developments, and many others, are dealt with this week in a special article. It is not inappropriate to refer here to the appointment a few weeks ago of a committee under the chairmanship of Lord Weir to report on the electrification of the main lines of Great Britain.

The potentialities of industrial heating are so vast that we publish an article devoted to the subject in this issue. An interesting inception during the period under review was the granting of statutory powers for the Galloway hydro-electric scheme. The peculiarity of this station is that it is to be designed for operation at a load factor of only 20 per cent. This design permits of a lower capital cost than would be the case with continuous working, and enables some 100,000 kW to be sent out to the grid at times of peak load.

Of schemes put to work during the year, the most important has been the making alive of the 132-kV line of the Central Electricity Board between Dalmarnock and Bonnybridge last May. At about the same time another section of the primary grid was also made alive, though temporarily at 33 kV, between Bedford and Little Barford. These brought the Board on to the plane of an operating supply undertaking.

Two new generating stations have been started—the Longford station at Coventry and the new Peterborough station. Arrangements have been made officially to open Slacks Valley station at Oldham this week, and Hams Hall station at Birmingham on November 6th, while the Portishead station at Bristol is also approaching completion. Longford was fully described in our issue of November 9th, 1928, and Peterborough in our issue of July 12th, 1929. Other notable achievements of the past twelve months include the completion of the T.S.S. *Viceroy of India*, the first large passenger ship to utilise high-pressure steam and to be fitted with turbo-electric propulsion equipment.

In reviewing, perforce somewhat superficially, the events of the past twelve months, one is conscious not so much of actual achievement in a relatively short space of time as of the putting in hand of work whose fruits will be seen in years to come.

Electric Fires.

During the past two or three years there has been a considerable improvement in the design of electric fires, although fundamentally they have not altered. In the matter of elements, for instance, more attention has been paid to the projective effect of the mounting. Fireclay bases are now often made with troughs of parabolic cross section, the coiled wire element being fixed along the focal line. In some cases the surface of the refractory former is broken up into little parabolas, each of which helps in throwing the heat forward. The parabolic shape is also employed in the reflector type of fire, particularly in the bowl pattern. The large reflector of parabolic cross-section is effectively used in the "Ferranti" fire, which is mentioned in the article upon electric fires in this issue. At one time it appeared that the "clip-in" type of fire-bar was becoming a *sine quâ non*, but, although it is employed in a large number of designs, it does not seem to be regarded as essential yet. In fact, the public may look upon the provision of easily-replaced elements as a confession of weakness, and it is perhaps not wise to stress this feature, although such elements are usually as strong as the more firmly fixed patterns.

The new season's catalogues reveal very little that is novel. As usual manufacturers have contented themselves with the improvement of existing models or the introduction of fires of the same general characteristics. There are one or two novelties, such as the "Rippleray" fire and the "Inventum" ceiling heater, which are described in our article.

It is in externals that the majority of the fires differ from their predecessors. Wider ranges of finishes are available (as in the "Jackson" fires), fires have been ornamented a little more to heighten their appearance, or, conversely, they have been made a little plainer to bring down the price. This mention of price leads us to remark that on the whole prices are on about the same level as last season. With such a wide choice, however, any prospective customer should be able to find an electric fire to suit his taste and pocket.

Electric Cooking and Water Heating.

Up to the time of our special domestic issue of last year it had become almost a habit to refer to the two schools of thought with regard to the design of hot plates for electric cookers—advocating the open and closed types, respectively. Happily that position is now past, supply engineers having forced the issue in favour of the closed plate on the score of maintenance costs.

The inclusion of an electric kettle with each cooker is another point which has done much to bring electric cooking apparatus to its present position of popularity, and consideration of this point brings us to the close relation between cooking and water heating. In connection with any cooking operations it is essential to have a ready supply, or a ready means of supply, of hot water which can be obtained cheaply. It is probably not generally realised that the hundred-and-one requirements for small quantities of hot water during cooking processes, boiling, steaming, tea-making, and so on, including the

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important, but tedious and unwelcome, business of "washing up," all directly and largely affect the cost of cooking. It must be borne in mind that the simple, efficient, and cheap means of obtaining small quantities of hot water on the ordinary gas stove by "putting the kettle on" cannot be exactly emulated in connection with electric cooking, and also that the problem must be tackled from quite a different angle. Non-appreciation of this point has resulted in many a returned cooker.

Bearing on this matter, we were very interested recently to learn that one large undertaking in this country, well advanced in the work of domestic electrification, is advocating the use of a small electric geyser in conjunction with each cooker, in preference to an electric kettle. We are not prepared to discuss the respective merits of the use of the geyser and the kettle, except perhaps to point to the obvious difference in cost, but some of the points put forward in favour of the geyser offer much food for thought.

It was shown from several points of view that without the electric geyser the electrical industry had nothing successfully to compete with the popular domestic appliance of the gas service. For instance, the geyser is unique in that it will at all and any times give instantaneous supplies of very clean hot water. For the supply of larger quantities of hot water, of course, the electric geyser is out of the question, but the desirability, or otherwise, of using the smaller appliance, with loadings up to, say, 4 kW, we commend to our readers as a subject suitable for consideration and healthy discussion.

The Brighton-Eastbourne 132-kV Line.

As announced elsewhere in this issue the Minister of Transport has given his consent to the erection of an overhead transmission line from Brighton to Hastings *via* Eastbourne. The consent is subject to further consideration of the position of the line and its supports near Offham and to the power to review the situation in five years' time. This decision may be said to be a satisfactory outcome of the inquiry, in that it will secure the amenities at Offham and will give some comfort to those whose objections are *bona fide* on æsthetic grounds, since, if the lines do prove the eyesore that they have been led to expect, they can look forward to raising the question again after not too long a period. We regard this as satisfactory, because we think that in five years the line will seem so much a part of the natural order of things that nothing will be heard against it then. Likewise, the Central Electricity Board will have come to be regarded as an integral part of the electrical industry, and therefore opposition not based on æsthetic grounds will have died a natural death.

The case will serve as a precedent in other districts, which cannot pretend to the same eminence as the South Downs, and where legitimate objections can be met by minor modifications which will not appreciably interfere with the general scheme.

The Work of E.D.A.

In such an issue as this an article from the pen of the Director and Secretary of the British Electrical Development Association is practically an essential feature. All branches of the industry look to E.D.A. to render the public mind receptive of their particular forms of the "electrical idea," and with the limited means at its disposal the Association does very well.

No doubt very few of the general public know of the existence of E.D.A. (they may have noticed its name in some of the newspaper advertisements), but we think that it is true to say that thousands of people have felt its influence, and have been led to make further inquiries regarding the subtle agent for which it stands. The interest aroused by its "Lighting the Homes of Britain" campaign was remarkable, and that effort was responsible for the addition of hundreds of consumers to supply authorities' systems. Everybody now knows that no form of illumination can approach electric lighting, and the Association is going on to convince the nation that heating and cooking can best be done electrically. Lampholders are not good enough for these purposes; already they are sadly overloaded. There must be adequate wiring with convenient "outlets" or plug points in every room if electrical service is to be used to its fullest extent. Therefore supply authorities and electrical contractors must support E.D.A.'s efforts in this direction by every means in their power. They must impress upon architects, builders, and their clients the fact that a properly-wired house is a valuable asset, thoroughly up-to-date, and the acme of convenience and comfort.

While appealing for this form of active support we would remind our readers that the lines of communication must be kept open and "munitions" must be provided. The Association can be trusted to perform these services in an adequate and efficient manner if the necessary funds are forthcoming. All branches of this great industry must remember that E.D.A. is not a charity, but an investment trust.

The South Yorkshire Coalfield.

The South Yorkshire Coal Owners' Association has taken up a page of *The Times* with an advertisement of the benefits to be derived from pit-head generation. Much of this manifesto will meet with general agreement, but, as we read it, there appears to be inconsistency in the main argument. The Association considers the national grid scheme to be "right in conception," but deprecates the building of large coal-fired stations in the area, on the ground that large quantities of surplus energy can be produced from existing plant at the pits to meet all needs of the locality.

The reason for the selection by the Central Electricity Board of coal-fired stations in the area is not merely for the sake of meeting local requirements by their means, but because such stations are well situated with regard to supplies of water and coal, and the ability to utilise favourable sites is surely one of the main tests of the advantages of the grid. If the coal owners have the surplus capacity available, they are not precluded by the presence of large power stations in the neighbourhood from disposing of any energy they can spare to the Board for use, whether in South Yorkshire or elsewhere. Indeed, such a possibility seems to have been clearly envisaged in framing the 1926 Electricity (Supply) Act, which gave the Board powers to enter into arrangements for the purchase of surplus energy on agreed terms. If the costs are lower than those at the selected stations, so much the better for the scheme as a whole.

Thomas Alva Edison.

On October 21st, 1879, Thomas Edison made his first successful experiment with an electric lamp having a carbonised cotton thread in an exhausted glass bulb.

The jubilee of that early experiment will be celebrated next week in the U.S.A. on the magnificent scale that is associated with a national effort in that country. Edison is now in his 83rd year; the testimonial given to him in his old age signifies that he still retains his hold upon the imagination of his fellow-countrymen. Much of his prestige is due to his possession of the qualities referred to in his own epigram that "genius is 1 per cent. inspiration and 99 per cent. perspiration," and shows also that a prophet is not necessarily without honour in his own land.

Although in Great Britain there is a proper pride in the facts that Sir Joseph Swan's original lamp, which was exhibited at Newcastle-upon-Tyne in December, 1878, and again in the present year, was actually the first practicable electric lamp, and that when, at a later date, the two men joined forces, it was Swan's process which was used in manufacture, full credit can, nevertheless, be accorded Edison for the brilliant services he has rendered to electrical science in so many directions. We therefore desire to add our tribute to that paid to the genius of Mr. Edison by all those with electrical interests throughout the world.

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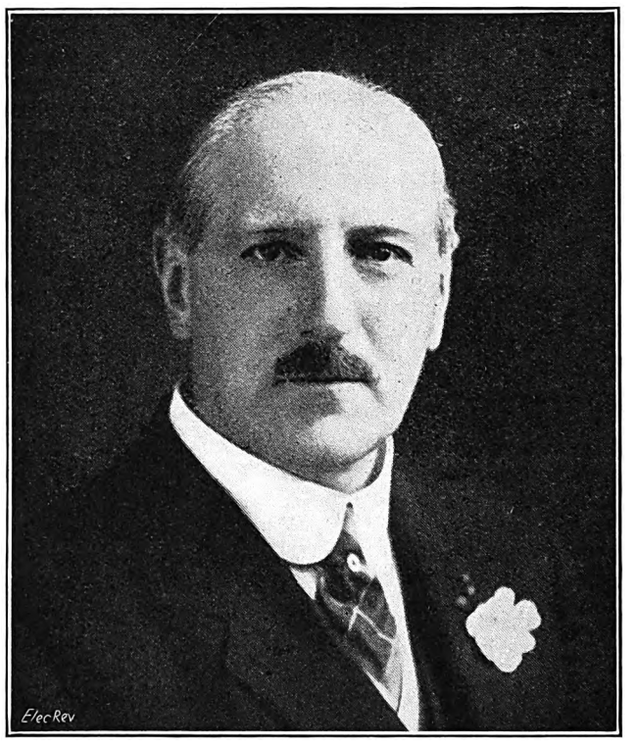
Colonel Sir Thomas F. Purves.

President of the Institution of Electrical Engineers for the 1929-30 Session.

THE election of Colonel Sir Thomas Fortune Purves as President of the Institution of Electrical Engineers is both a reminder that telegraphy and telephony constitute the senior service in the electrical industry, and a recognition of the still increasing importance of this service in our everyday life. It is now barely half a century since this service was, in effect, the electrical industry (as the original name of the Institution and also of this journal indicated) and, however great the advances made in the newer branches, whose future could in those early days be but dimly foreseen, they have not yet exercised a more potent influence on our business and social conditions than has the progress made in the science of electrical communication.



Col. Sir T. F. Purves, O.B.E., M.I.E.E.

Some idea of the growth in this branch may be gained by a reference to the work carried out by Colonel Purves, since his appointment to succeed Sir Wm. Noble as engineer-in-chief of the Post Office in 1922. Particulars of these developments were given in the Electrical Review for March 8th last, p. 436, when we offered him our congratulations on the occasion of his receiving the accolade of knighthood from His Majesty the King. The most important of these recent developments may be summarised as follows: the provision of a network of underground main cables between all important towns in Great Britain, involving the installation of many thousands of repeaters and valve amplifiers, which have made satisfactory speech possible irrespective of distance; the extension of telephone communication to nearly all the countries of Europe; the establishment of public radio-telephone service with the United States, and its extension to Europe and South America; the linking up of the Empire by radio-telegraph; and the introduction of the automatic telephone system into London and its extension to the provinces.

Sir Thomas Purves has been a Post Office man throughout his professional career. Born at Blackadder Mount, Berwickshire, on December 31st, 1871, he received his technical training at the Heriot Watt College in Edinburgh, where he won the first medal awarded by the college for electricity and technical telegraphy. As a result of this success he was appointed to the engineering department of the Post Office in Edinburgh at the age of 21. In 1894 he became a draughtsman and afterwards technical officer in the engineer-in-chief's office in London. After successive engagements as assistant superintending engineer for the London district and for the southern district of England, he was placed in charge of the designs section of the engineering department, which gave him responsibility for the control of technical development and the supply of all classes of apparatus and plant used in telegraphy and telephony.

In the early days of the war he devised, and sent to the armies in the field, various adaptations of telegraph and telephone apparatus for use under conditions of trench warfare, and as a result he was invited by the Director of Army Signals in France to make systematic studies of the conditions of communication in the war zones. For this purpose he received a commission as major in the Royal Engineers, acting as liaison officer between the army signal services and the productive resources of the Post Office. During the course of the war he designed a large number of new types of electrical signalling and detecting apparatus for various military purposes, the manufacture and supply of which also came under his control. It was largely due to his efforts that in the later phases of the war, the system of electrical communication of the British Armies reached an efficiency far beyond that of any other combatant nation.

At the end of the war he received the Order of the British Empire and was promoted to the rank of Colonel of the 44th (London and Home Counties) Division of the Royal Corps of Signals.

In June, 1919, Col. Purves was appointed assistant engineer-in-chief of the Post Office, in succession to Sir William Noble, whom—as related above—he again succeeded three years later in the senior position. The great responsibilities of the engineer-in-chief to the Post Office may be gathered from the recital of recent constructional work which was given above. In addition to such development duties, however, there are those of operation and administration. The latter include the supervision of electrical plant of all kinds (whose value is over one hundred millions sterling) and an annual expenditure of over fifteen millions on construction and maintenance, as well as the control of more than 35,000 men. To this large staff the appointment of a chief who had earned their confidence and respect, both as an able engineer and as a sympathetic administrator, naturally proved very gratifying, especially on account of his known view that it is not possible to carry on a great industrial concern efficiently without a feeling of mutual trust between the staff and the administration.

Sir Thomas has represented Great Britain at many international conferences. He was largely instrumental in setting up the International Governmental Committee on Long-distance Telephony in Europe, which has produced so remarkable an extension of world telephony within recent years, and has presided over the section of that Committee which deals with the technical aspects

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of the subject. He was also head of the British delegation attending the recent world conference of some 400 delegates at Washington, presided over by Mr. Hoover, which was convened for the purpose of revising the International Convention and Regulations (originally formulated in 1912 in London) governing the use of radio-telegraphy, telephony, broadcasting, &c.

Col. Purves's connection with trans-Atlantic telephony included the classic occasion in August, 1927, when he, in company with many other prominent British electrical engineers, sitting in the I.E.E. buildings on the Thames Embankment, held a joint conference with American engineers, sitting in the American Institute in New York.

Colonel Purves has been connected with the Institution since 1902. Like his predecessor in office, he has served six years on the Council of the Institution, in the last three of which he has filled the position of vice-president. The good wishes of all will be accorded him during his presidential year.

Five Years' Experience in an All-Electric House.

Records of the consumption of electrical energy, its cost, and comments on the results of its domestic use, which have confirmed the author's initial hope and substantiated his expectations.

By Professor S. PARKER SMITH, D.Sc., M.I.E.E.

PROBABLY after five years' experience one's views on the running of an all-electric house can be regarded as fairly normal and settled. If at the outset a certain amount of initial enthusiasm was apparent, assisted by a healthy opposition to what was an innovation to many, ample time has now elapsed for a calm survey of the situation to be made, while the results over a quinquennium may be accepted as a fair measure of what may be expected under stated conditions. Further, the question whether an all-electric house is satisfactory for a layman can now be answered with a certain amount of assurance. It was not so easy to give a definite reply when the question was originally addressed to an electrical engineer at a time when certain appliances were still in the experimental stage and reliability of service had yet to be experienced. That a certain amount of pioneering proved to be essential in 1924 will be gathered from the writer's original paper on " An All-Electric House " in the *Journal* of the I.E.E., Vol. 64, p. 289, and from articles in the Electrical Review, Vol. 101, p. 663, and *World Power*, Vol. 5, p. 7, and Vol. 6, p. 137. This development work was of two kinds—the one kind which always accompanies departure from existing methods and is commonly referred to as birth troubles or infantile ailments, the other kind arising from the desire for improvement. Progress during the last five years has practically removed any cause for anxiety, and this has been accompanied by the reduction of tariffs over wide areas. This is well illustrated in the modern electric cooker, which is still fitted with boiling plates; but these are now more reliable, while their low efficiency is largely offset by lower charges for energy. Consequently it would seem safe to say that, given good workmanship in the installation and good appliances, the layman has no cause for alarm in the idea of an all-electric house. As regards reliability of supply—a matter of some concern to the author before embarking on the scheme—it can be said that only once in five years has the service been cut off. The failure in that case lasted some five minutes.

Without attempting to draw an analogy, it is perhaps permissible to mention that many drivers of motor cars have no engineering knowledge. It will generally be conceded that the chance of any untoward happening in an all-electric house is far less than in a car, yet day by day many non-technical drivers set out on their journeys with the greatest confidence, and the majority of them reach their destination safely.

Maintenance and Changes.

Maintenance in an all-electric house is an astonishingly small item. Lamps need renewal, but this is not peculiar to an all-electric house. Also a fuse blows occasionally, and the chance of this happening naturally increases with the number of circuits. Flexible troubles have been largely overcome by the use of stout cords: by using the same heavy flexibles on flat-irons, kettles, toasters, table lamps, &c., as on fires, the life of the flexible has been increased almost indefinitely. Then from time to time an element burns out, either in a fire, kettle, iron, or cooking pot; but this trouble has now become very rare. Experience soon showed what appliances were reliable, and a process of elimination rapidly reduced burnouts to a minimum. In short it may be said that upkeep in an all-electric house is not an item that need be taken into account. Months will pass without trouble of any kind, then two or three slight, but of course annoying, mishaps may occur in the same week.

No very important changes have been made beyond eliminating unsuitable appliances. Despite charges of extravagance, it was soon found that more plug points were needed. Fortunately the remedy was simple, and most of the 15-ampere plugs are now arranged to take a 5-ampere adaptor. Another welcome simplication resulted from the adoption of universal-type sockets for use with small appliances, such as toasters, flat-irons, kettles, coffee percolators, &c., which greatly reduced the number of flexibles in the house. A certain number of fires were exchanged for more modern types, but as these are hired from the Corporation, the exchange merely resulted in an alteration in the cost of hire. At present this cost is £4 13s. per annum, or about 10 per cent. of the energy cost. The earlier changes in the cooker embodying the introduction of the 3-pin type of utensil with self-contained elements were reported in the Electrical Review, Vol. 101, p. 663. Later changes included replacement of the ordinary fuses by cartridge fuses to prevent the gun-like detonation when a fuse blew. Also the rather small oven on the table cooker was replaced by a larger oven finished with unchippable enamel and plated facings. The larger oven was accommodated on a separate stand, thereby making room for one more pot on the cooking bench. It is now possible to have four such cooking pots in use simultaneously, while the larger oven accommodates the awkward dimensions of the Christmas turkey, &c. It might be mentioned that these modern enamelled ovens, from which all parts can be removed, as in the Belling type installed, renders cleaning a simple matter. The larger oven, of course, has a somewhat higher loading. It is a nice problem whether to install an oven suitable for 50 or for 52 weeks in the year. The smaller " Highlow " oven made to suit the dimensions of the cooking bench gave good service

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and was big enough for most purposes. The larger oven is more generally handy because of its size, but costs more to run. As it is not feasible to install two ovens, the obvious solution is not the logical one.

For those interested in quality, it may be worth mentioning that the writer is still of the opinion that the plug-type utensil with self-contained elements, as illustrated in his earlier article (Electrical Review, Vol. 101, p. 663), is better to use than the ordinary utensil used on a boiling plate. The cost of the special utensils is the one and only drawback.

Consumption and Costs.

Results.—The following tables of consumption and costs are self-explanatory. The differences between the totals in Tables I and II are due to meter errors.

TABLE I.

Total Consumption in Units Recorded on Two-rate Main Meter.

Years of 52 weeks.	1st	2nd	3rd	4th	5th	Average p.a. in units.	Average p.a. in percentage.
Day load	10,299	9,713	9,079	10,727	11,720	10,307	64%
Night load	6,043	5,827	5,241	5,848	5,897	5,771	36 ,,
Total for year	16,342	15,540	14,320	16,575	17 617	16,078	100 ,,
House closed	19	10	13	8	7 days.		

TABLE II.

Analysis of Consumption in Units as obtained from Separate Meters.

Years of 52 weeks.	1st	2nd	3rd	4th	5th	Average p. a. in units.	Average p. a. in percentage.
Heating	5,954	6,636	6,585	7 781	8,265	7,044	42%
Hot water day	1,242	1,245	1, 03	993	1,315	6,951	41 5 ,,
Hot water night	6,043	5,827	5,241	5,848	5,897		
Cooking	2,777	1,858	1,706	1,963	2.037	2,068	12.5 ,,
Lighting	568	687	717	785	8-3	724	4 ,,
Total for year	16,581	16 253	15,352	17,370	18,377	16,787	100 ,,

TABLE III.

Total Annual Cost of Energy (Based on Figures in Table I.)

Years of 52 weeks.	1st	2nd	3rd	4th	5th	Cost.	Average p.a percentage.
Day load at ½d.	£ s. d. 21 9 2	£ s. d. 20 4 8	£ s. d. 18 18 3	£ s. d. 22 7 0	£ s. d. 24 8 4	£ s. d. 21 9 6	% 50
Night load at ⅜d.	9 8 10	9 2 1	8 3 9	9 2 9	9 4 3	9 0 4	21
Fixed charge	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	29
Total for year	43 8 0	41 16 9	39 12 0	43 19 9	46 2 7	42 19 10	100

Comments on Results.

(1) For the third year, an extra of £9 0s. 3d. falls to be added for the general strike of 1926.

(2) The increase in the fifth year is to be accounted for by the exceptionally severe winter of 1928-29. No discomfort was experienced, but fires had to be switched on for a longer period before the room was occupied. The longer time taken for cooking operations and heating water during that cold spell was pronounced.

(3) The fact that the extremes fall within 10 per cent. of the mean justifies the conclusion that a definite measure of the annual consumption and cost has been obtained.

(4) Experience soon showed that undue care in consumption was not necessary. Extravagance was, of course, avoided, but, except during the general strike, no particular economy in heating water, &c., was practised. All rooms have fires and occasional heating has greatly increased.

(5) The number of regular occupants in the house varied from four to six, whence it can be concluded that for such small numbers it is meaningless to express consumption or cost in terms of "per person per day."

(6) The average overall cost per unit over the five years worked out at 0.64d., or under two-thirds of a penny.

(7) The consumptions for heating and for hot water are almost identical; cooking is only one-eighth of the total, while lighting is negligible.

(8) Thirty-six per cent., or over one-third, of the total consumption was taken during the night (between 11 p.m. and 7 a.m.) when the station was running on light load. The value of this to the supply undertaking can be seen from the fact that the revenue from this source was over 40 per cent. of that from the day load. Moreover, as capital charges had been met out of the fixed charge of £12 10s., and the running charges were less than ¼d. per unit, the profit at ⅜d. was ample.

An All-Electric Flat.

The above house was built for all-electric service. As an example of a rather more common case, *i.e.*, that of conversion from gas and coal to all-electric working, the figures obtained by Dr. M. G. Say, of the Royal Technical College, Glasgow, may be of interest. The flat concerned had three apartments, with kitchen and bathroom. The Glasgow two-rate tariff was also applied, but there was no night load at special rate. A full range of heating, cooking, hot water, lighting and auxiliary services (*i.e.*, sewing, toasting, &c.), was taken. The consumptions and costs for the last two years are given in Table IV. Two fires were hired at a total cost of 12s. per annum.

Table IV.

All-electric Flat: Annual Consumption and Cost.

Years of 52 weeks.	First.	Second.	Average in kind.	Average as a %.
Consumption: units	6862	6987	6925	—
Cost at ½d.	£14 5 11	£14 11 2	£14 8 6	76
Fixed charge	£4 11 0	£4 11 0	£4 11 0	24
Total	£18 16 11	£19 2 2	£18 19 6	100

Average consumption per week ... ... 133 units.
Average cost per week ... ... 7s. 4d.
Average cost per unit ... ... 0.66d.

The average figure of 7s. 4d. per week for three persons for an all-electric service can be regarded as favourable, compared with other forms of fuelling. Further, the average cost per unit in this 4-roomed flat of 0.66d., compared with 0.64d. in the 10-roomed house, shows that the size of the installation does not greatly affect the economy of electric working. On the whole, the conclusions arrived at for the house apply also to the flat. Lighting is so cheap that the luxury of adequate lighting is enjoyed. The total lighting per room ranged from 250 to 500 watts. This enabled the use of colour-sprayed lamps, indirect lighting, &c., without the sacrifice of intensity.

During the exceptionally severe weather of the winter of 1928-29, difficulty was at first experienced in getting living rooms sufficiently warmed. Investigation showed that, with the fires standing in the dismantled coal grates, a considerable draught was being produced up the chimneys. By blocking the flues as in the all-electric house, the warmed air was circulated through the room before exit at the windows, resulting in comfortable warmth. This would suggest that, with the normal fires in the room, radiant heat alone becomes inadequate when the ambient air has very low temperature, and that a proper scheme of ventilation as in the all-electric house is essential.

No hot water storage was used. The existing 30-gallon tank was disconnected from the dismantled coal range, lagged, and provided with an immersion heater of 2 kW rating. Baths could be obtained in 2-2½ hours in summer and 3½ hours in winter.

The cooker was of the type for utilising pots with enclosed elements, and has given excellent trouble-free service.

In general, the absence of smoke, fumes, ashes, and dust was marked and appreciated. Annoyance was caused by slight shocks from kettles and from flexibles, especially on the flat-iron. The remedy of replacing all flexibles by the heaviest type proved quite satisfactory. The liability to shocks due to dampness, &c., emphasises the desirability of earthing all electric appliances in such places as kitchens and bathrooms.

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Progress of Electrical Industry.

The story of the assistance rendered by the British Electrical Development Association and that organisation's new campaign.

By Lt.-Col. W. A. VIGNOLES, D.S.O., M.I.E.E., Director and Secretary.

THE early history of the progress of the electrical industry is a story of the struggles of many individuals to harness, organise, and distribute the new form of energy.

The early engineers were, however, very communicative and, generally speaking, were glad to help others working in the same direction by giving them the results of their experience. In fact in the electrical profession there has always been a singular willingness to pool results, and, to-day, most electricity supply undertakings will freely answer questions as to their experience in any particular direction.

The formation of the British Electrical Development Association in 1919 carried this spirit of co-operation a stage further, as all branches of the industry are included in the Association, the members of the Council representing the Institution of Electrical Engineers and all the various associations connected with the electricity supply, manufacturing, contracting, and wholesale branches of the industry.

The problem which the Association set itself to tackle was that of increasing the use of electrical energy and the sale of electrical apparatus of British manufacture.

The Association endeavours to influence public opinion and to create in the mind of the public a desire for the advantages which electricity can provide. Such work must be in the interest of everyone connected with the electrical industry, as any increase in the output of electricity means that there has been a corresponding increase in the number of installations connected to the mains, in the number of electrical appliances sold, and at some stage an increase in the cables laid in the streets and the plant required for generation.

The Association endeavours to find new markets for the sale of electricity, as well as to develop those demands which already exist, and assists the electrical industry by providing information on all matters connected with the commercial development of the use of electricity.

To deal with these matters the Association appoints from time to time sub-committees to carry out special investigations, and the reports of these committees are circulated throughout the industry. Some recent reports issued by the Association deal with electric furnaces, rivet heating, the use of electricity in school domestic centres, electrical refrigeration, &c.

The Association commenced operations in a small way, but during the ten years of its existence some £200,000, provided by the industry, has been expended on propaganda work, the amount during the last few years being between £35,000 and £37,000 per annum.

The value of the co-operative advertising of the electrical idea is very great, as everyone in the industry, whether they have made a contribution or not towards the cost, obtains the advantage of the total amount expended on propaganda; so that, for instance, a supply company, say in London, contributing a few hundred pounds a year, shares in the benefits of a scheme upon which between thirty and forty thousand pounds has been expended.

In these days of quick communication and rapid interchange of news and information, national advertising of a product, such as electricity, is very effective, and the benefits of any scheme are very evenly distributed among supply undertakings, the results averaging out all over the country.

The advertising of the use of electricity carries with it necessarily the purchase of new installations, and also the purchase of apparatus, and the contractor and manufacturer are, therefore, vitally interested in the work of the Association.

The manufacturer may claim that he can do better by advertising his own products directly, but it is the opinion of many advertising experts that there are limits beyond which individual advertising efforts and expenditure are subject to diminishing returns; that is to say, as the bulk of advertising grows, the individual efforts of the competing firms tend to cancel one another to some extent. Beyond a certain point, therefore, co-operative advertising is more fruitful, as it can be concentrated on developing the public taste without advocating any brand of goods.

Even in the first stages of advertising, co-operative effort is economical, as the creation of the demand for the service must precede the sale of any particular make of apparatus. This creation of the demand, or the "selling of the idea," is the most difficult part of any campaign, but the success of co-operative effort in other industries shows that this is the most effective way of tackling the problem.

It is suggested that all electrical manufacturers should devote a portion of their advertising allocation to a contribution to E.D.A., to be spent on general propaganda, following this up with individual advertising of their own particular products.

The manufacturer working on these lines, while he may not get direct benefit from his contribution to E.D.A., will certainly obtain his proportion of the benefit derived from the total expenditure of the Association, which, as stated above, is at present about £35,000 per annum.

Supply undertakings are contributing about £22,000 per annum to the Association, the scale of subscription being 1/10th of 1 per cent. of the revenue of the undertaking from electricity supply. Manufacturers are asked to contribute to the funds of the Association a somewhat similar percentage of their turnover, or corresponding proportion of their advertising allotment.

The Association is able at the present time to give very considerable assistance and service to undertakings and firms in the industry by the supply of blocks for local advertising, by the provision of publicity leaflets, folders, &c., of which nearly 30 millions have been issued by the Association, by the provision of high class posters, arranging lectures, the provision of lantern slides, kinema films, and designs for shop window displays. The Association also gives assistance to its members in the organisation of exhibitions.

The activities of the Association include conferences on salesmanship and development matters and special editorial Press activities.

One of the greatest fields for the development of the use of electrcity is undoubtedly the domestic field, and the Association has spent a considerable proportion of its funds on this phase of development, and conducted two special campaigns in 1926, 1927, and 1928, which were directed towards the better lighting and greater use of electricity in the home.

It is interesting to note that the Americans are now beginning to realise the possibility there is for development in the domestic use of electricity. In this con-

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nection Mr. M. S. Sloan, president of the National Electric Light Association of America, in his presidential address at the last Convention said that the average use of electricity in the homes in the U.S.A. was 460 kWh per house connected for the year 1928, and made a plea for increased domestic sales.

The figure given is an interesting one, and I am inclined to think, although I have no national figures which I can advance in support of my view, that the consumption of electricity per domestic consumer in Great Britain must be substantially higher than the figure quoted. In Glasgow, and similar areas, the consumption is in the neighbourhood of 800 units per domestic consumer, but how far the average of the whole country differs from this figure it is impossible to say, as no statistics are available, the figures for domestic consumption being usually obscured by the inclusion of shop and commercial lighting.

Particulars were recently given in an electrical paper of an undertaking which is selling over 1,000 units per head of population in the area, largely due to heavy industrial demands; this is a wonderfully fine result, and every credit should be given to the management which has secured this amount of business. On the other hand, I have recently heard of an undertaking where the consumption per domestic consumer connected to the mains is said to be approaching 1,000 units per annum, and it would be interesting to know if other undertakings can show better results than this.

It would be a great advantage if all undertakings would give particulars to enable this development to be watched; what seems to be necessary is for undertakings in their figures for sales to show as a separate item the amount sold for all domestic purposes, and to report the number of houses connected to the mains. Such statistics are available for electricity supplies in the U.S.A.

In this particular development the chief obstacle in the mind of the public is the bogey of cost; this has been encouraged by our competitors, as, our product being so perfect, it is about the only argument that can be brought against it. This bogey can best be laid by steady national propaganda dealing with the question on broad lines, and this is part of the work which E.D.A. is carrying out.

The use of electricity in the home is frequently restricted by the fact that no adequate wiring is provided, and this sometimes brings about very unsatisfactory home made temporary connections.

The Association is, therefore, this year conducting a special campaign to impress on the public the necessity for a satisfactory electrical installation in any house which they may buy, build, or rent. This campaign will be carried on throughout the country by means of lectures, advertising, conferences, &c. The result of this work should be to the general benefit of the whole electrical industry, and should make the electrical installation a more important part of the building of the house. It should increase the average size of the installation, and should very definitely increase the use of electricity.

One section of the campaign will be specially directed towards the speculative builder (who after all provides a large proportion of the houses built in this country), and towards the public that buys these houses. The object will be to induce the public to regard adequate wiring as part of the normal equipment of a house. Once the demand has been created the builders will undoubtedly have to supply it, while we will also show the builders that on estates where adequate wiring has been provided the sale of houses has been assisted.

The campaign is designed to benefit the industry in every area, but the greatest results, as in all campaigns, will be obtained where local efforts are made to follow up the national effort; the campaign in fact offers a very suitable opportunity for co-operative work between supply undertakings, contractors, manufacturers, and wholesalers.

The platform upon which all sections of the industry can meet to discuss these commercial problems is that provided by an E.D.A. circle; with the recent re-organisation of E.D.A. Area Committees, and the adoption of representation of circles on the Area Committee, and of Area Committees on the Council, the means are at hand for every individual, firm, or undertaking to take their part in the great co-operative effort which is needed to obtain the greatest results from the campaign.

Judging from the experience gained in the other campaigns, it is certain that those circles, undertakings, and individuals who co-operate most closely in the work of the campaign will be most satisfied with the results obtained.

Domestic Service.

Socket Outlets are the Key to the Position.

By H. WILLOUGHBY ELLIS, A.M.I.E.E., President of the Electrical Contractors' Association

IT is a platitude to say that domestic electrification has immense possibilities: to the electrical man of vision, the thing is self-evident; but ways and means to turn those possibilities into actualities are by no means equally clear.

Advancing from platitude to paradox it may be said, and with peculiar truth, that domestic electrification is hindered, not in the least by gas and oil and candles, but very sensibly indeed by that persistent old rascal "electric light."

Facing the facts as they are, what do we find? Tens of thousands of houses more or less wired for electric light, but with never a socket available for such a minor item as a bowl fire. Here and there we shall find a fair sprinkling of the smaller appliances—domestic irons, vacuum cleaners, wedding-present toasters, and so on—all provided with lampholder adaptors and used occasionally, with needless trouble and inconvenience, by their severely handicapped owners.

Such, without exaggeration, is the situation prevailing in the bulk of middle-class British homes to-day, and the problem before us is to secure the wholesale amendment of this fundamental and most obstructive difficulty.

To digress for one moment, is it not surprising that, even at the present moment, such a wealth of attention, effort and money is devoted, by "assisted" and other wiring schemes, to rope in a few more hundred *lighting* consumers of the smallest cottage type? All this effort is made to insert the thin end of the electrical wedge in new property—"new," that is to say, from an electrical point of view—but little special effort seems to be made to reap the benefit of the thick end of the wedge by driving it home in the tens of thousands of fairly substantial, but electrically incomplete houses, already referred to. What is the value to the whole industry—supply, manufacturing, and retail alike—of an ordinary lighting consumer, as compared with an all-electric, or substantially electric, ordinary householder? The one consumes his

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thirty or forty units a quarter and buys a few lamps: the latter consumes his 600, 800 or 1,000 units a quarter and buys—well, substantially more than a few lamps!

Reverting, however, to my opening theme, no good purpose is served, of course, by bewailing the past. In point of absolute fact, there is nothing to bewail. Until recent years, from a domestic point of view, electricity represented a lighting service alone, and we have to thank "lighting" and "lighting installations" not only for all past prosperity in this field, but also for making the public familiar with electrical precision, cleanliness, dependability and simplicity.

On the other hand, the fundamental and serious difficulty provided by these tens of thousands of installations, designed for lighting alone, must be kept clearly in mind if only to avoid their repetition and perpetuation under the entirely changed conditions of to-day. In this direction the need for intensive propaganda among architects and builders, as well as among ordinary members of the public, is only too apparent, and credit will be given to the Electrical Contractors' Association for publishing an important little volume on the subject ("Electrical Security: Installation Work Good and Bad") and ensuring its distribution among architects and other professional men in every part of the country.

This brings me to the first necessity of the moment, namely, for electrical men themselves to give up talking and writing about "electric light," and to concentrate every ounce of their strength and resources in preaching the gospel of *electric service*. Not so many years ago we used to be plagued by people who insisted upon writing and talking about "*the* electric light." Providentially those individuals have now gone to a better land (or learned better manners); and the same educational process is needed concerning those who constantly prate about electric light, even without the "the." Changing times call for a changed outlook and changed phraseology. One of the most urgent needs of the moment is to take electric light for granted, and to push electric service, and adequate socket-outlets, by every means at our command.

The Electrical Review will achieve a most valuable reform if it persuades the whole industry to think and talk in terms of domestic electrical service (with light thrown in, or taken as a matter of course); but the journal will achieve far greater renown, and far more striking results, *if it succeeds in persuading the average electrical man to be a whole-hog user of his own commodity.*

It is agreed that there are certain areas in this country where an all-electric, or substantially electric, domestic service is not yet possible. There are areas where rates of tenpence or so for lighting, and threepence or more for heating supplies, are still in force, and those areas are frankly impossible from a domestic service point of view. But in vast areas to-day we have reasonable, all-in rates. Only recently the County of London Company, that Aunt Sally among metropolitan supply authorities, reduced its all-in domestic running rate to three-farthings per unit, and no excuse whatever exists for the electrical man, resident in such areas, who fails to adopt all-electric operation, or something uncommonly near it, as his own domestic standard.

No good purpose is served by remarking that the shoemaker's children always wear the most broken-down boots; electrical men are not snobs—in this, and I trust, any other sense—but it is a matter of common knowledge (and nothing to our credit) that electrical men have been woefully slow to set an example to the rest of the community in the matter of employing all-electric domestic service in their own homes.

To give up talking and writing about "electric light," and to make full domestic use of electricity in our own homes, therefore represent the first steps to be taken in the great forward movement now gathering momentum in this country. With an amended outlook, and vivid *personal experience* at our backs—an indispensable factor in talking to that conservative individual "the lady of the house"—we shall be in a position to move with the times, *and lead the times*: to see that members of the public are provided with no more meagre lighting installations; and to put our backs into the current E.D.A. campaign for more, and yet more, socket outlets in the homes of Britain.

No more important point can be stressed at the present moment. Provide the householder with the means to use electrical equipment, and the apparatus will be purchased and put to work with the utmost freedom. The socket outlet is the key to the whole position. In the absence of a comprehensive socket outlet, movement domestic electrical progress will be slow and tedious beyond words.

The suggestion is thrown out for what it may be worth, but, in connection with electrical competitions and other advertising propaganda, would it not be advisable for the bulk of the "prizes" to take the form of so many socket outlets duly installed? At the present moment, for example, the E.T.B.I. has a competition in progress in connection with which an astonishing number of electrical prizes are offered, ranging from electric fires and kettles to wireless sets; but it is at least thinkable that, instead of giving equipment, the installation of so many socket outlets might produce results of greater permanent value to industry. The point, of course, is a small one, but *no* opportunity should be lost to increase the facilities for using electrical equipment. Provide the facilities and the equipment will be bought.

The final point I would make is simply this: the whole electrical industry, from top to bottom, must set its face resolutely against shoddy installations and shoddy equipment. Cheapness, at the expense of quality, must *not* be the alpha and omega of electrical salesmanship.

To harp everlastingly on this question always appears to me to be particularly degrading: my own personal inclination would be to ignore the criminal wasters in our midst; but since the public cannot be expected to discriminate between good and bad work (how on earth is it possible for them to do so?) it is most clearly apparent that the industry itself must entertain no two opinions on this vitally important matter.

Lighting, which we are endeavouring to expand into something else, is an entirely different matter. I will venture to suggest that bad work in connection with an ordinary, small lighting installation, is very largely a matter of academic interest; but bad work in connection with a domestic power installation represents a source of real danger, and is of the most vital significance and consequence to the whole industry. Time after time the "lighting minds" in our midst fail to see the need for installation precautions of any sort being taken. Wholly absorbed in the carpeted-floor, *lighting conditions* of the past, they fail to see the factory *power conditions* reproduced in the tiled floor and "earthed-metal" kitchens of to-day.

Providentially, however, the voice of these obstructionists is becoming steadily weaker, and in this direction I feel that a compulsory code of wiring regulations would be of the utmost value both to the public and to the trade. Clearly enough all the compulsory rules in Christendom will not prevent the shoddy worker executing his shoddy work, but such compulsory rules, representing the electrical law of the land, would bring the fake installation man within the grip of the law and exercise a most salutary effect on his moral outlook and material activities.

There is not the slightest need for an army of inspectors, or other officials, to administer such compulsory rules. Half-a-dozen prosecutions and convictions would do more to "cook the goose" of the shoddy worker, and to put the fear of personal punishment into him, than all the inspectors or "compulsory registration" in the world.

It is submitted, as quietly as possible, but none the less sincerely, that some such legal control of installation work must be instituted in this country in the near future. Apart from the growing use of electric power in urban and suburban residences, vigorous efforts are to be made to secure the use of electricity in rural areas—in farm buildings, cowsheds, stables, and so on, and in stone-flagged farm kitchens—and the industry will suffer untold damage unless due care be taken to see that these people are given a square and safe electrical deal, not here and there, but everywhere, all the time.

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Women's Influence on Electricity.

The influence which women can exert in all matters relating to the electrical equipment of the home is so manifold as to be almost limitless.

By CAROLINE HASLETT, Director and Secretary of the Electrical Association for Women.

THE woman's point of view, as home-maker, is one which is likely to have a very considerable effect upon the design of domestic electrical apparatus. She is beginning to demand that more and more attention shall be given, not only to the artistic side of home lighting, but also to the design and general appearance of electrical apparatus, such as fires, cookers, and washing machines. She is no longer just content to have the efficiency which electricity gives her, but she is gradually insisting that that efficiency shall be decorative as well.

There is, undoubtedly, a revival of interest in home-making, which is taking an entirely new line. The modern woman, who has been trained at Domestic Science Centres and Colleges, is anxious that her home shall be run on the most up-to-date lines. Contrary to the housewife of the 19th century, her "house-proudness" takes the form of confining her household duties to a few hours during the day, and not allowing herself to become a household slave during the whole of her waking hours.

Women are rapidly realising that efficiency in household work will be brought about mainly through the agency of electricity, but they will not be content merely with having labour-saving appliances dumped into their homes; they will not tolerate inconvenience, even electrical inconvenience!

The outcome of this attitude of mind has been the Electrical "Outlet" Campaign devised by the Electrical Association for Women, the object of which is to bring to the attention of architects, builders, and electrical engineers, the need for installing more electrical outlets in the home in order that women can use their electrical labour-saving appliances *when* and *where* they wish, without the great inconvenience of continually tripping over long flexible cable leads.

The cooker inquiry conducted by the E.A.W. a short while ago, whereby women expressed their point of view with regard to the design of cookers, has resulted in a number of interesting improvements in new-model cookers. Manufacturers are beginning to realise the need for meeting the requirements of the home-maker, as evidenced by the number of inquiries received by our Association when new apparatus is being designed. Clearly, we must make up our minds that women are developing a very real electrical intelligence, and anything which is less than the very best will not be tolerated in their homes—and this brings us to the problem of how the manufacturer is to be brought into close touch with women's electrical needs. Here is undoubtedly the opportunity for co-operation with the skilled woman demonstrator and saleswoman, whose duty it should be to learn what the woman requires, as well as to spread knowledge of what exists.

In connection with the employment of women as saleswomen and demonstrators, it seems proper to state that if the electrical trade is really awake to the enormous value of such co-operation, it can only attract the trained and skilled woman by paying her an adequate salary. One has only to consider the very excellent example set by the Newcastle-on-Tyne Electric Supply Company to realise the value of such a policy. Certainly the electrical trade will in the near future need to spend some time and thought on this subject, which will become increasingly important as time goes on.

At the moment, practically no facilities are offered to promising young juniors to gain experience, the demand mostly being for women who have already done similar work in other showrooms. There appears to be a need for women to serve as probationers in electrical shops and showrooms, where they can begin to get an understanding of the every-day requirements of dealing with customers. Several attempts have been made to set up training centres for women who wish to enter the electrical industry, but there is undoubtedly a need for closer co-operation between training establishments and the large electrical firms, in order that the pupils may get some practical training in ordinary commercial surroundings. It may not be possible for the electrical industry as a whole to set up a central training establishment, but the idea seems to me to be one well worthy of consideration.

In addition to the woman in the home and the woman working in the electrical industry, there is also a growing interest in the subject of electricity amongst women who are doing valuable work on public bodies of all kinds. The small, but growing, army of women who serve on electricity committees and the larger body of women on housing committees are all in their own special fields exerting influence on the development of the domestic uses of electricity. That powerful organisation of country women known as the Women's Institutes is taking a very practical interest in the subject of rural electrification. Women public speakers, women journalists, and women who broadcast radio-telephonically are all influencing what we may term the woman's electrical outlook. In a very practical way, the woman builder, such as Mrs. Willson, of Halifax, the woman house decorator, the woman property manager, and the woman architect, are all watching with interest the latest electrical developments, which are leading towards the ideally labour-saving and beautiful house.

It is certain that the woman with a knowledge of what electricity can do will have a very material influence on the architecture of the houses of the future. She will realise that with the elimination of chimneys and their attendant fireplaces, which in the past have controlled the placing of the windows, doors, and furniture, she will, with the electric heater, which can be placed in any part of the room, be given entire freedom and a new conception of where the fittings and furniture may be placed; also, with regard to the furniture, a complete change over may take place as often as it suits the whim or convenience of the home-maker.

An essentially practical interest in the electrification of the home is being shown by teachers all over the country. Domestic science teachers, who are gradually coming into touch with electrical apparatus in their class-rooms, are beginning to feel the need for a fuller knowledge on the subject, and the teaching world in general recently joined in a deputation to the Board of Education to ask that the Board should provide special instruction classes for teachers on this subject.

It would seem right and proper that every girl during school life should be allowed to cultivate some acquaintance with electricity, how it works, and what it can do to lessen labour in the home.

A further group of women who are exerting some influence, although perhaps a restricted one owing to the smallness of their numbers, are the women who have been trained, or are in training, as electrical engineers. Miss M. Partridge, who is doing excellent work in Devonshire in training girl apprentices to carry out house wiring, is opening out an entirely new and attractive field for women.

Here and there, also, one finds a woman acting as publicity expert, or in the research department of a

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large electrical firm. In this connection it would seem desirable that all electrical firms engaging large numbers of women for their staffs, as typists and clerks, and in their factories, should endeavour to give the girls some real understanding of the value of electricity in the home, as those girls will, in the future, be setting up homes of their own.

The E.A.W. Newcastle Conference gave some indication of the very practical and intelligent interest which women of many nations are now taking in this great subject. On every hand we see signs of the tremendous potential development of electricity in this country, and if we are to build up the domestic load which engineers generally are looking for, then without doubt the active co-operation of women will very materially assist towards this national achievement.

Electrical Illumination.

Progress in its Domestic, Commercial, and Industrial Applications.

By W. J. JONES, Manager of the Lighting Service Bureau, London.

THE story of the part played by electric light in the service of man is not only one of wide scope and universal interest, but is an epic of the struggles of inventors and engineers who have given to the civilised world one of its greatest assets. It concerns the creation of disturbances in the imponderable ether we choose to call "Light," which, by serving the sense of sight, constitutes the most powerful means we have of gaining knowledge of the world in which we live. As produced artificially in the incandescent lamp, it extends the hours of our activities independently of the supply of light directly available from the heavens. There have been workers and seers in the electric lighting industry who rank second to none in the history of the last 50 years—the development of the modern dynamo, the invention of the first practical electric lamp by Sir Joseph Swan in 1878, the improvements effected by subsequent workers, and the setting up of electricity undertakings—all these make us proud to be associated with the electrical industry.

Whither are we going, and in what way are we developing, especially in electrical illumination? These are questions which it is worth while trying to answer at periodic intervals. It appears to me, as one who is intimately associated with development, that the general public who use electric light are in some directions more advanced in their appreciation of its possibilities than are members of the industry itself. We engineers in the past, and many of us at the present day, have spent so much of our time haggling over the minimum requirements for lighting the home, the shop, the factory, and the street, when we should have been devoting our whole energies to exploiting in every way possible the services which electric light has been proved to render. We have "split lumens" when we should have been concerned with the increased facility for seeing which is afforded under double or treble present-day intensities of lighting. In this way, electrical engineers have, in many instances, definitely stayed development. Apart from economic considerations, I, personally, do not know of any limit to the intensities of electrical illumination which can be employed with advantage to visibility, so long as glare and its associated evils are absent. Engineers and the lighting industry in general should, therefore, devote themselves to the problems of electric light, rather than waste undue time upon prescribing minimum standards of illumination.

Let me back up my argument with an example. The older type of shopkeeper provides some form of lighting in his premises, both in the interior and in the window, so that the business can be carried on after sunset, and the installation consumes on a liberal basis some 300 watts. He is just able to see, and his customers, with considerable inconvenience, are just able to see the goods. Now the modern shopkeeper has realised that such lighting is totally inadequate and represents a charge on his business, and he is prepared, therefore, to install two or three kilowatts of lighting as a paying proposition, since in addition to affording lighting for good visibility, it makes his window display and premises generally a source of attraction; indeed, the lighting becomes an advertising investment which promotes sales and pays direct returns through larger turnover. A similar situation prevails in the factory. Why handicap workers by providing the minimum possible amount of light when the use of higher intensities has been shown to possess economic advantages, paying for itself in the improved character and greater quantity of the work? In the office and in the home, who can prescribe how much light is enough? Each successive year sees the introduction of higher intensities of illumination, and again, when free from glare, these installations inevitably give greater satisfaction than those which they replace. In the parsimonious use of electric light, we are doing our customers a disservice.

Now let us turn to the more commercial aspects of the subject. Electric lighting has been known for half a century, and it has been the means of building up the electrical industry as we know it at the present day. The electrical industry is recognised as being one of the most flourishing, and one in which there is a reasonable return in the way of profits—built up on lighting. Returns indicate that nearly 50 per cent. of the total revenue of the electricity supply undertakings is obtained from lighting. There is also an indication in official returns that power consumption is responsible for some four times the amount of electrical energy, but that the revenue is only 47.8 per cent.

Electrical interests in general are awakening to the importance of organised electrical development, and this cannot fail to bring its reward, but I submit that a very considerable proportion of the total efforts in electrical development should be devoted to the extension of the lighting business, because of the fact that such a high proportion of the revenue of electricity undertakings is obtained from lighting, and that lighting represents the "entering wedge" to other electrical services. A highly esteemed friend of mine in the electrical industry (with whom I disagree) maintains that "we have heard so much of the thin edge of the wedge, why not let us get on with developing the thick edge of the wedge"? My reply is: "Why neglect the thin edge of the wedge when it can, in these days, be driven home so readily, and when it represents the most precious and valuable part of electrical investments" Indeed, very few supply undertakings have a planned and deliberate lighting development policy. Quite recently, a campaign was conducted to improve shop lighting in a suburb of Stuttgart where the load is entirely confined to lighting. This necessarily involved the installation of more lighting appliances and a greater demand for electricity, and the peak increased as a result of these development activities only by some 5 per cent., while the consumption of units increased by 20 per cent. In other words, the cure for a lighting peak is lighting development. With good lighting the consumer automatically switches on earlier and switches off later. While on this question of peak loads,

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it should be borne in mind that the tariff of a supply undertaking is invariably adjusted accordingly to ensure that a profit is made. Whichever way one looks at this question, there is no justification for curtailing lighting development on the "peak load" argument.

There is another important change taking place in the lighting business because of the introduction of "architectural lighting." Whatever may be our

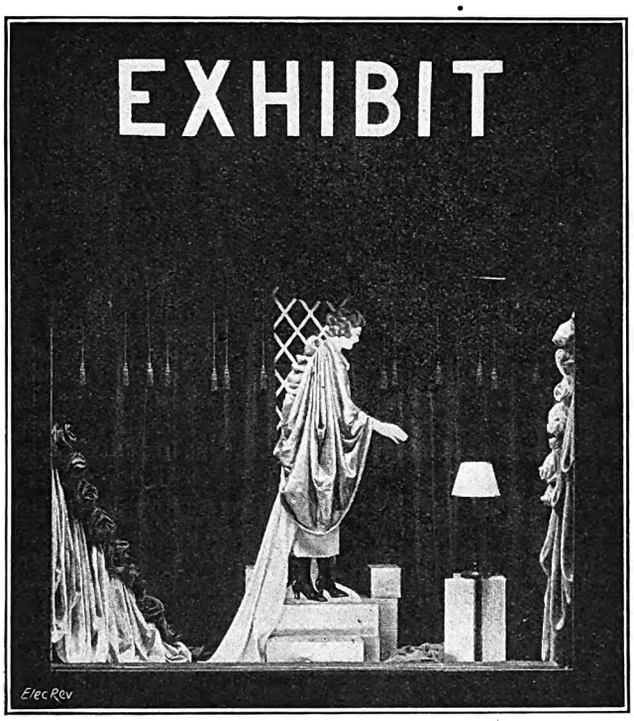

Fig. 1.—Modern Fascia and Shop-window Lighting.

opinion of any particular form of architectural lighting, I do not think that there is any doubt that, possibly in some modified form, it has come to stay. Certainly it gives a new interest to the shop front and wonderful opportunities in the design of our public buildings. Its development is vastly to the advantage of the electrical industry. In the survey which the Lighting Service Bureau conducted some few years ago, it was found that the average shop could be well lighted by ordinary methods by the installation of some two or three kilowatts of lighting. Nowadays, because of the development of architectural lighting, similar shops are installing from 10 to 20 kW, and in certain Oxford Street examples, the installation on two floors of 11 ft. frontage and 60 ft. depth amounts to no less than 105 kilowatts! Some few years ago, we were talking of tens of thousands of units being available from lighting installations. Already there are notable stores and restaurants each consuming one million units per annum.

One of the most fruitful fields for exploitation of all interests in the electrical industry is that of the lighted fascia. Thousands of shops in this country willingly spend £20 or £30 per fascia, especially designed in wood or glass. Why should not some of this money be diverted to the electrical industry? For very little extra expenditure it is possible to install a lighted fascia which has a good daylight appeal and at night-time perpetuates the name of the shopkeeper. Many of these fascias take as much electrical energy as the shop window itself, and other sections of the industry besides the central stations stand to benefit because of the lamps and wiring supplies involved.

The electrical authorities in Belgium this autumn are engaging in a kitchen lighting campaign. It will be remembered that I reported on my return from the United States on the tremendous field for lighting development to be opened up by campaigns of this character, and that in Philadelphia alone, by a campaign for better lighting facilities in kitchens, the load of the undertaking was increased and the revenue benefited by the sale of millions of units. This undertaking has a definite development department with a section devoted entirely to the development of lighting. I hope that the results of experiments which are being made at the present time in this country will persuade supply undertakings to engage more specifically in lighting development than they have done in the past.

Most of us were under the impression that the quantity of electric street lighting was small, compared with that from other sources of illumination, but recent statistics show that no less than 33⅓ per cent. of the total street lighting in the country is already electric, and there are many important towns which have their thoroughfares entirely electrically lighted. The supply of energy for street lighting represents 6 per cent. of the supply from authorised undertakings, and in view of the poorly-lighted streets of our cities, there is in this field, too, an enormous opportunity for expansion. It is unfortunate that in some areas electric street lighting is retarded because of unwarrantably high charges for electricity. Whatever be the arguments put forward for charges for lighting in other fields, the mere fact that street lighting on a 4,000-hour basis per annum represents a 50 per cent. load factor should be sufficient to ensure that energy is supplied at terms at least as favourable as for power. At the present time, the total sale of electricity for public lighting in the United Kingdom amounts to 114,000,000 units per annum, and has doubled itself in the last four years.

In conclusion, it is important that everyone within the electrical industry shall do his part towards its rationalisation, whether the effort be directed towards tariffs, standardisation of voltage and frequency, or the standardisation of appliances. In this connection, the simplification in types of electric lamps, especially in the domestic range, will save much duplicated and wasted effort, while the fact that this rationalisation of the lamp industry is coupled with an attempt to reduce glare, will enable an all-round better service to be given

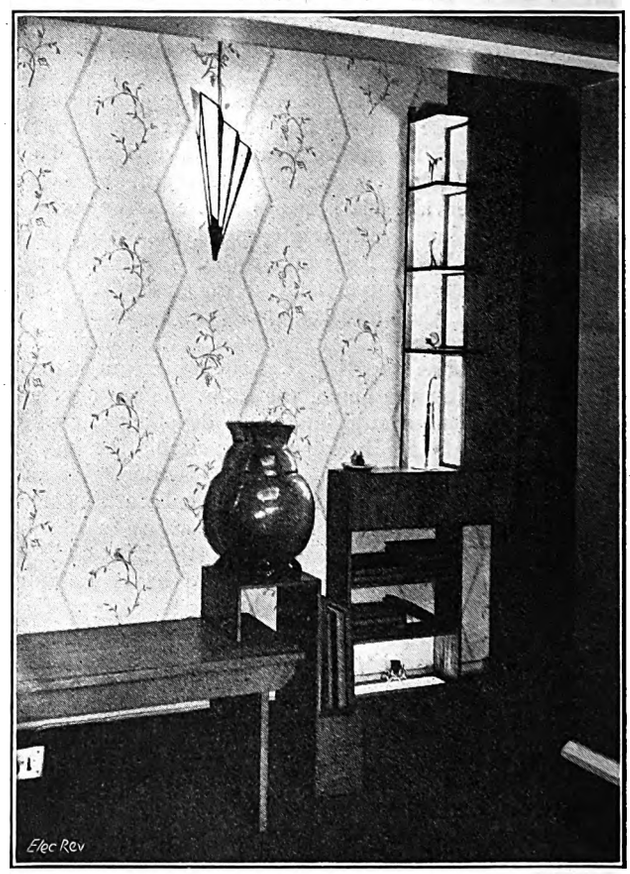

Fig. 2.—Light as Part of a Furnishing Scheme.

to electric light users. Better lighting service in its broadest sense will assuredly bring about a great expansion in the lighting industry to the advantage of all.

The illustrations accompanying this article show an example of modern fascia and shop-window lighting (fig. 1) and a modern lighting development—lamps built into the furnishings (fig. 2).

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Recent Developments in Heavy Electrical Engineering.

A review of progress recently made in certain directions by plant of British manufacture.

By FRANK WALKER, A.M.I.E.E.

IN preparing the following article on recent developments in heavy electrical engineering, the author has considered that, having in mind the wide field to be covered, and also the relatively small space available, the most interesting way of dealing with the subject would be by a review of recent notable heavy electrical engineering achievements. In this article no reference is made to large electrical generators.

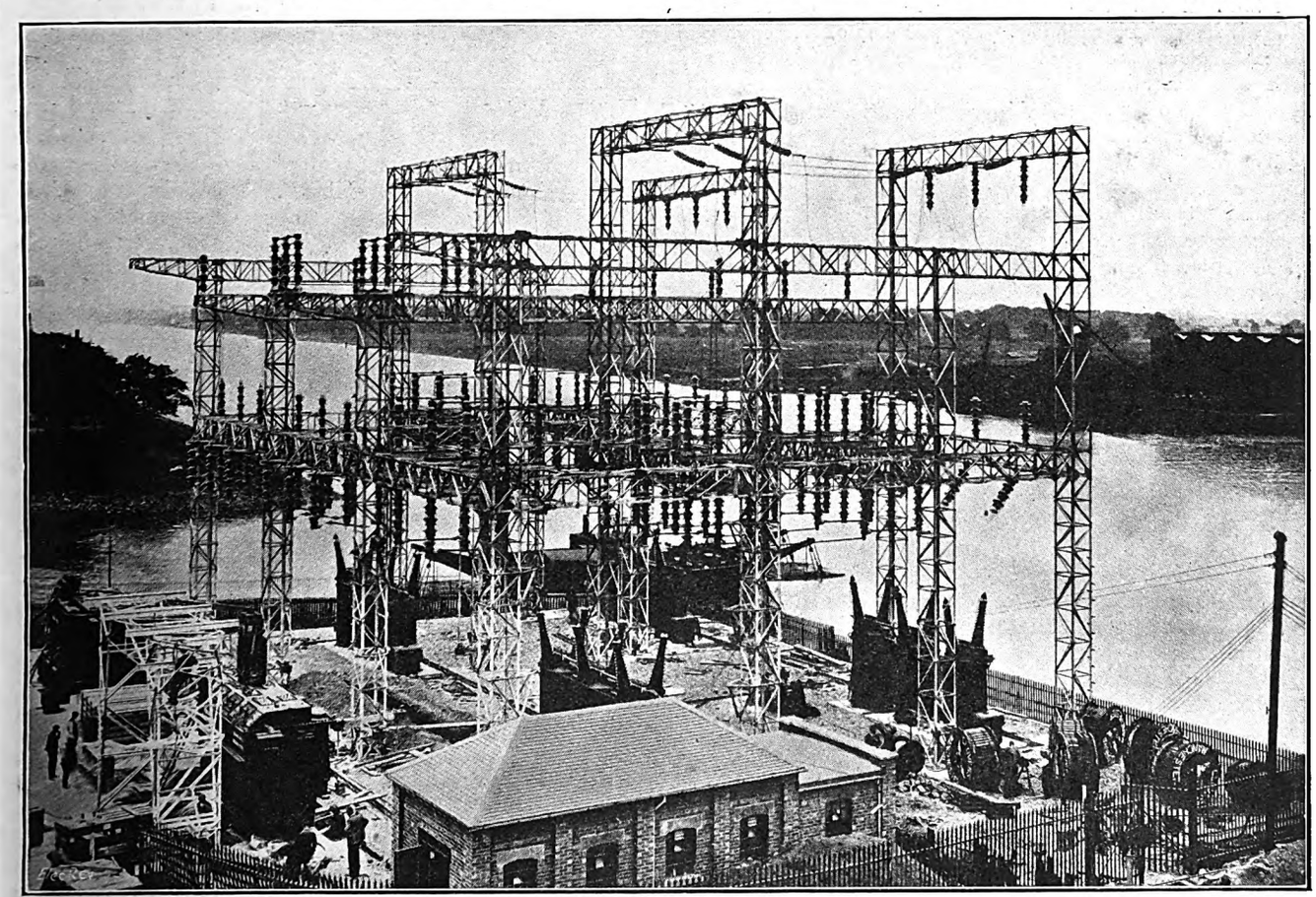

Fig. 1.—A 132-kV Grid Sub-station at Yoker.

There can be little doubt that the most important development in electrical engineering at the present time is that of the grid transmission system in Great Britain; for the Central Scottish section of this undertaking, which was the first to be commenced, work on the transmission towers and sub-stations is well advanced, fig. 1, which shows one of the grid sub-stations nearing completion, will be of general interest. This sub-station is situated at Yoker on the west ring of the Central Scottish section of the grid. It is designed for 132,000 volts and has four circuit-breakers.

A typical grid transformer was illustrated in the ELECTRICAL REVIEW for May 10th, 1929, p. 820; it showed a single-phase unit of 20,000 kVA capacity, three similar units forming a 60,000 kVA bank. The transformers are arranged for delta-star connection, and are suitable for either step-up or step-down service.

By means of contactor type gear, operating on tappings connected near the permanently earthed high-voltage neutral point of the transformer, on-load voltage regulation is provided to give a total variation of + or − 10 per cent., in steps of 1.43 per cent. To bridge the sections of the transformer winding while changing from one tapping to another a reactor is provided, which also, by giving a mid-point running position between each pair of tappings, reduces the number of tappings to be brought out of the transformer, and also reduces the number of contactors required.

The transformers are designed to give 60 per cent. of their full rated output, when na urally cooled by means of the radiators shown in the illustration. Each transformer is also provided with a separate oil cooling plant, which is started or stopped automatically as the transformer output exceeds or falls below set limits, and includes a circulating pump and an air blast cooler, the latter consisting of a series of gilled cooling tubes assembled with a motor-driven fan as a compact unit.

Temperature indicators are fitted to show on dials the temperature of the oil, and also that of the windings, the latter device being arranged at a set temperature to operate lamp and horn alarms, and also, in the event of a further increase in temperature of 10 deg. C., to close a trip circuit and open the oil circuit breaker.

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For convenience in transport the radiators are made detachable, and are fitted at top and bottom with valves

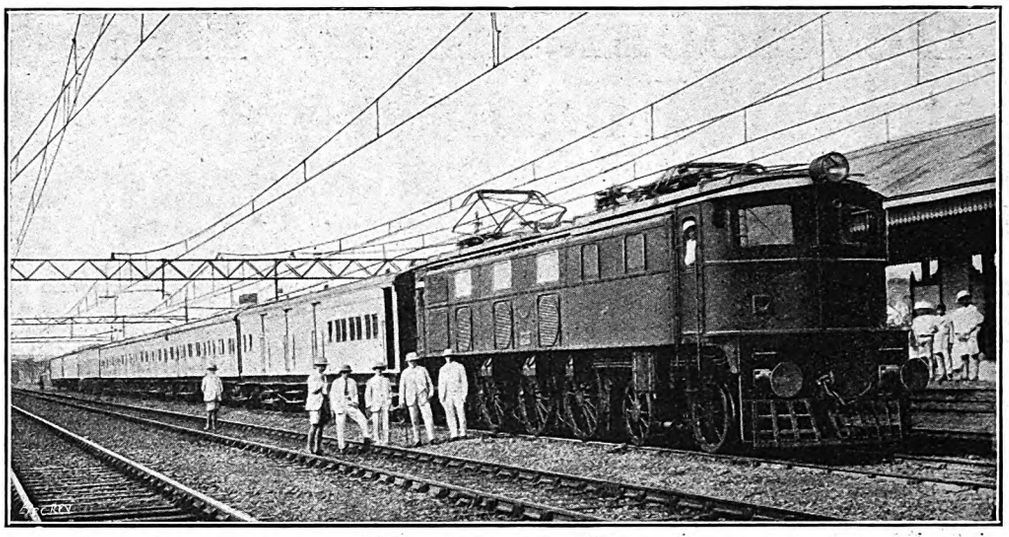

Fig. 2.—Locomotive and Passenger Train, G.I.P. Railway.

in both directions, to avoid the necessity of removing the oil from the tank body. The problem of transporting transformers of the size described presented no little difficulty, and has only been solved by the design of a special type of railway truck.

The above brief outline of the main features of 20,000-volt single-phase grid transformer units should be supplemented by a reminder that considerably larger three-phase transformers, of 75,000 kVA capacity, are being constructed for the grid, particulars of which may be hoped for at a later date. A group of 132,000-volt oil circuit breakers for the British grid is shown in fig. 4. It will be seen that separate cylindrical tanks of strong steel plate are provided for each phase, and at the left of the illustration will be noted the remote controlled electrical operating gear. The operating gear is of the solenoid type, and is connected through a bell crank lever with a horizontal rod that passes across the top of the three tanks through systems of levers giving a straight-line motion to each of the three sets of moving contacts.

Fig. 6 is of special interest as showing three out of twelve metal-clad compound filled switchgear sections installed recently in the Portobello power station of the Edinburgh Corporation, having a total weight of 372 tons.

The equipments include two 32,500-kVA generator units, five feeder units, one reactor and bus coupler unit, and four units for transformers stepping up to 132,000 volts for connection to the Scottish grid system. The equipment is insulated for 12,000 volts, although working at 6,600 volts. The generator circuit breakers are rated at 3,500 amperes, but are designed to carry 4,000 amperes within B.E.S.A. temperature limits.

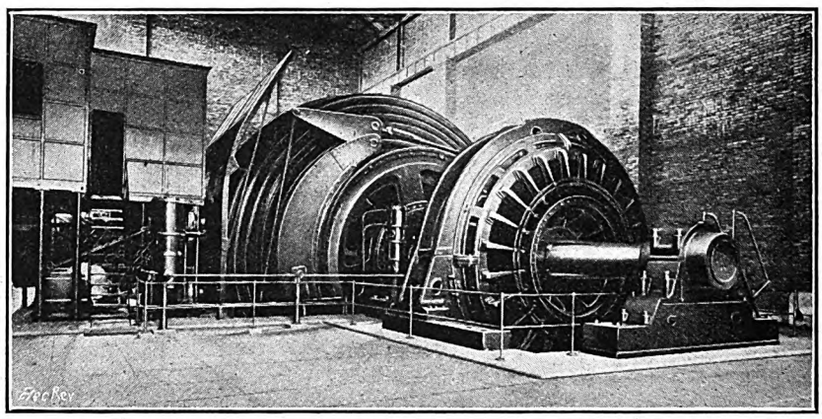

Fig. 3.—Winder, with 5,000/12,500-h.p. Motor.

The busbars are designed for a normal current of 4,000 amperes, and have a copper section of 15 sq. in. They are made in hollow square section for the more efficient conduction of heat to the outside casings, and because skin effect would make the inner portion of little use. Following the usual British practice, each circuit has only one circuit breaker, transfer from one set of busbars to the other being effected by electrically-operated oil-immersed selector switches.

The phases are completely subdivided, and both isolators and selectors, in addition to the oil circuit breakers, are electrically operated from the control room. An important feature is that provision is made for the safe removal and replacement of the potential transformer fuses and resistances when the circuit is alive and without interruption to the supply, an arrangement which also facilitates cable testing with the isolator oil tanks in position. The moving contacts of the circuit breakers consist of two sets of Y-shaped brushes per pole, a construction which, during the passage of heavy currents, gives the advantage of increased contact pressure in consequence of the mutual attraction between the two halves of each brush. Further important features are a complete system of interlocks to ensure correct sequence

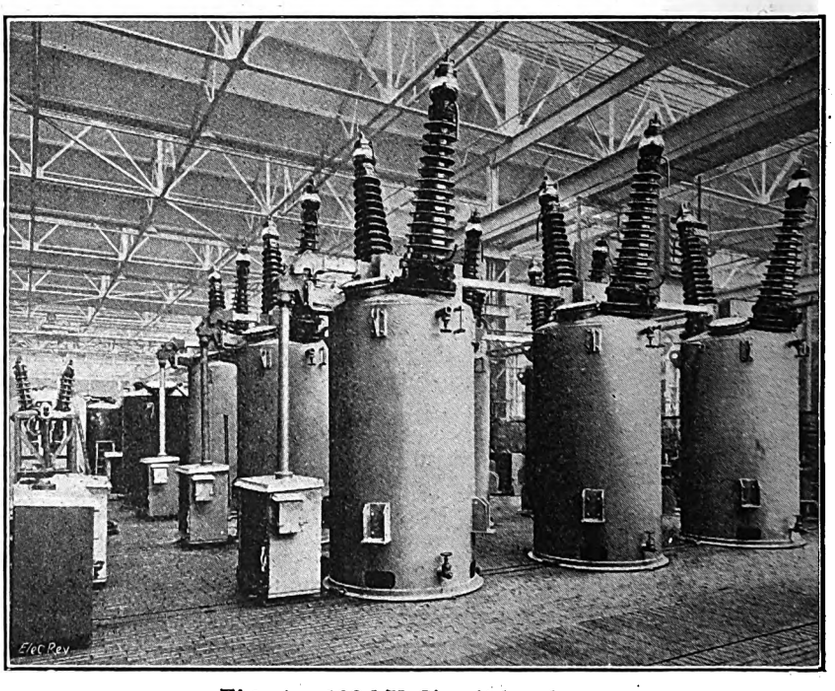

Fig. 4.—132-kV Circuit-breakers.

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in operation of the isolators and oil circuit breakers, and to prevent access to live metal under ordinary operating conditions, and also the provision of special means for closing the breakers slowly by hand for brush adjustments, &c.

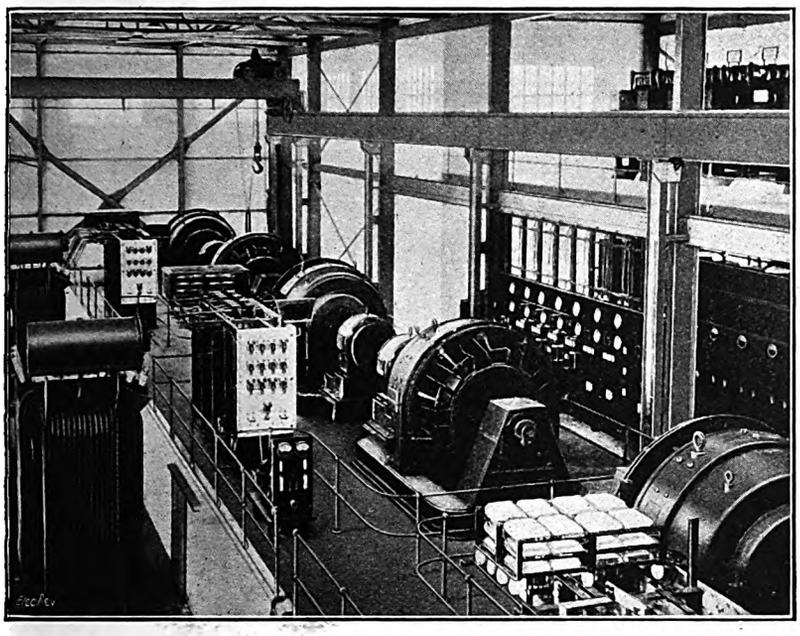

Fig. 5.—Unattended Sub-station on B.B. and C.I. Railway.

In reviewing recent developments in the field of electric traction, a brief reference may be made to the great success that has attended the electrical equipment of the 171 route miles from Glencoe to Pietermaritzburg of the South African (Natal) Railways. It will be recalled that for this undertaking the equipment for the power station, the sub-stations, and the 3,000-volt d.c. overhead line, together with 95 1,200-h.p. electric locomotives for regenerative working, either singly or up to four in series under single operator control, were of British manufacture.

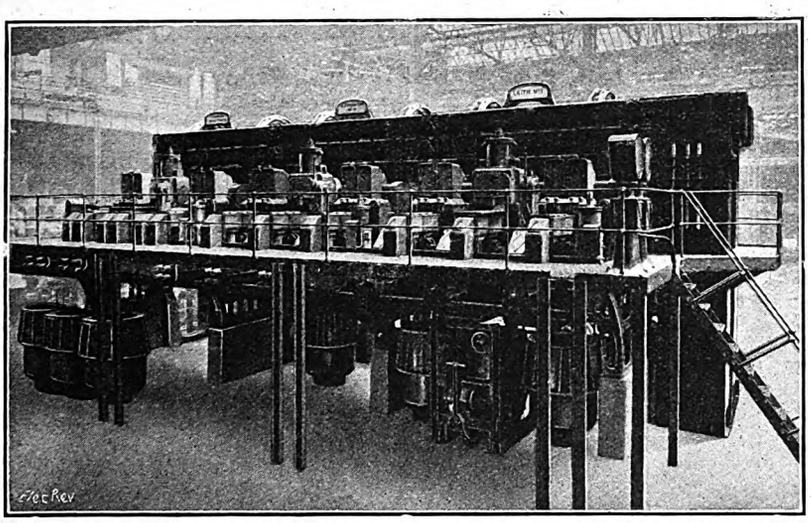

Fig. 6.—6.6-kV Switchgear for Portobello Station.

Another railway electrification undertaking that should be mentioned as using British equipment, including electric locomotives, is that of the Great Indian Peninsula Railway. On this railway the work of electrification is making continued progress. The 86 miles of main line from Kalyan to Poona is now completely equipped, and is to be opened officially on November 5th of this year; early completion is also anticipated of the equipment of the 52 miles from Kalyan to Igatpuri. It will be recalled that for this railway 41 2,600-h.p. electric locomotives for freight service have been supplied, and 22 2,160-h.p. electric locomotives for passenger service are now being completed by British manufacturers, one of the latter being shown hauling a passenger train in India in fig. 2.

Among suburban railway electrification schemes, notable progress has been made by the Southern Railway, which has now 269 route miles and 743 track miles converted to electric working, and has further extensions in progress. The electrically equipped rolling stock includes some 832 motor coaches and 760 trailer coaches, and is illustrated by fig. 9, which shows a typical train on the recently equipped extension to Tattenham Corner.

Another notable electrification undertaking is that of the Sydney Suburban Railways of the New South Wales Government, on which over 450 motor coaches and over 450 trailer coaches are in service, and where the equipment of further sections of the suburban lines is projected, the completed scheme to reach a total of about 400 track miles.

Special reference should be made to the suburban railway electrification of the Bombay Baroda and Central India Railway. This electrification covers 23 route miles, of which part includes double-track and part four-track equipment, making in all 57 track miles.

A notable feature of this scheme is that there are no manually controlled sub-stations. There are five sub-stations, two of which have three sets of rotary convertors, as illustrated in fig. 5, showing the sub-station at Bandra, while the third sub-station has two sets of rotary convertors. Each set of rotary convertors consists of two 1,250-kW, 750-volt machines, arranged to operate together in series to give 2,750 kW at 1,500 volts d.c., which is the required line pressure. A special feature of this system is that all three sub-stations as well as two track sectioning cabins are fully automatic, and are operated by a selective supervisory control system from a control office situated 17 miles from the most distant unattended

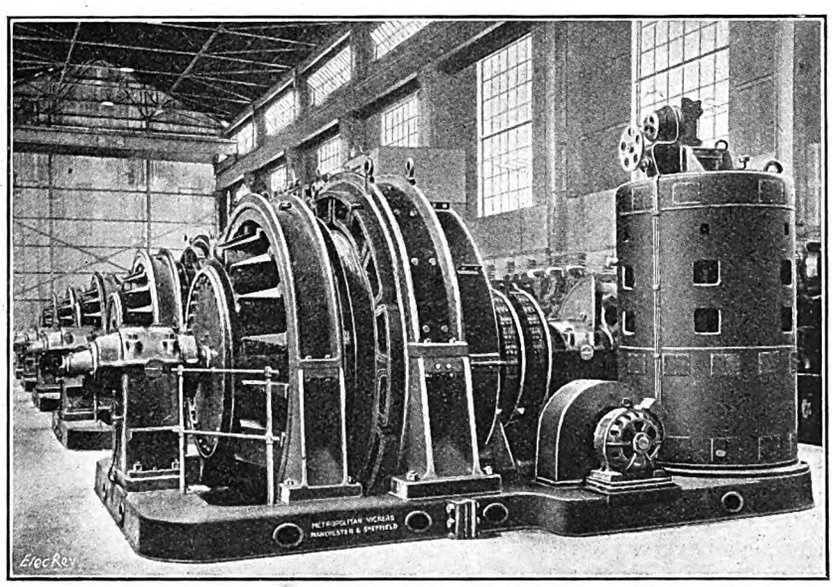

Fig. 7.—8,000-A Rotaries in Rhodesia.

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sub-station. Another railway electrification scheme to employ automatic sub-stations with selective supervisory control is the extension to the Buenos Aires suburban lines of the Central Argentine Railway now in progress. For these extensions, which bring the electrically equipped lines to approximate totals of 45 route miles and 92 track miles, five new sub-stations and two new track sectioning cabins are being installed. The sub-stations will be equipped with rotary convertors of 2,000 kW capacity. One sub-station having three such machines, three others each two machines, and the fifth sub-station one machine only.

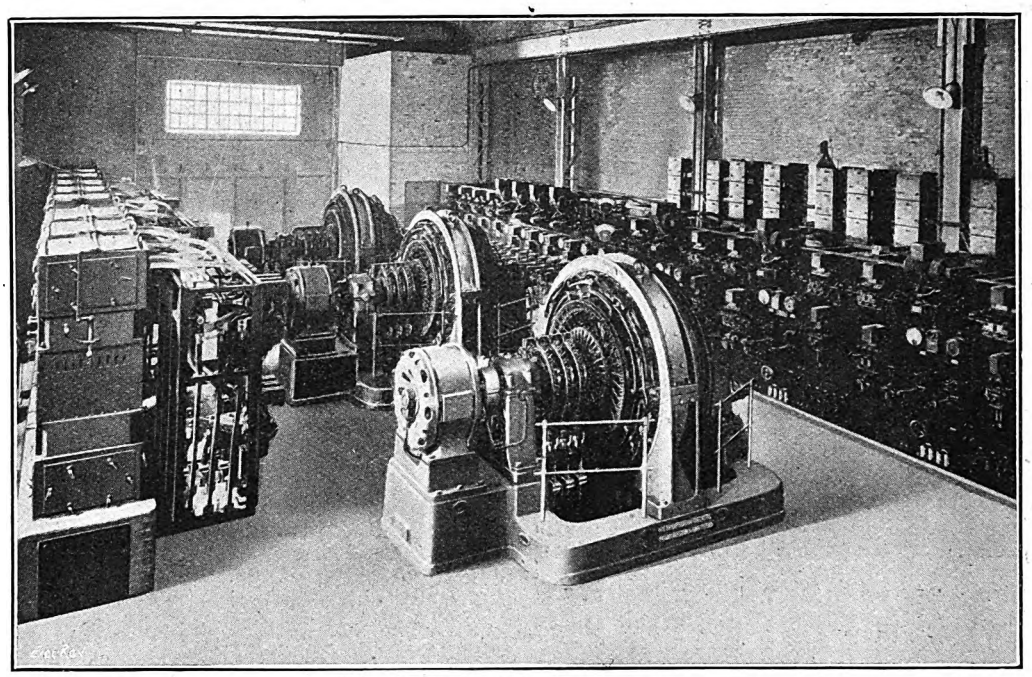

Fig. 8.—Unattended Sub-station, London Underground Railways.

All five sub-stations as well as the two track sectioning cabins will be entirely unattended, and will be controlled from one of the older manually operated sub-stations by a selective supervisory system through the medium of three small wires.

It may be of interest to add that the sub-station extensions now in progress include also the provision of four 2,000-kW rotaries for manual control to be installed in the older sub-stations.

The above reference to unattended sub-stations, controlled through three small wires from a central office, recall the fact that the first fully automatic sub-station to be installed in Great Britain was started up in Liverpool so recently as October, 1922. This equipment, which consists of a 500-kW rotary with the necessary control gear, has now functioned successfully for a period of seven years, and is thus a notable instance of what can be done with well designed and well made electrically controlled unattended sub-station power plant.

Since the above date British manufacturers have made great improvements in apparatus for automatic control, and have supplied many hundred equipments for installation in all parts of the world to control rotary convertors, motor-convertors, hydro-electric generators, synchronous condensers, transformers, and feeders. A typical installation is illustrated in fig. 8, which shows the Balham automatic sub-station of the Underground Electric Railways of London. This station, with three 1,500-kW rotary convertors and air blast transformers, is left entirely unattended, and is controlled by push buttons at South Wimbledon.

In association with automatic control gear, a brief reference may be made to the use of apparatus of this type to simplify the control of large machines, *e.g.*, the control of three 4,500-kW rotary convertors supplied to Sydney, N.S.W. Automatic apparatus has been installed that requires of the attendant nothing beyond the operation of a press button; in other instances, *e.g.*, machines of 2,000 kW and 3,000 kW capacity installed in Buenos Aires, the heavy circuit breakers necessary have been arranged for electrical operation, to be controlled from a small panel equipped with the necessary small control switches.

Passing from automatic sub-stations, a brief reference may be made to an interesting installation shown in fig. 7, which shows five rotary convertors installed for electrolytic work in Rhodesia. The machines are of 1,760 kW capacity with double commutators and rated to give 8,000 amperes continuously at 220 volts. To obtain the constant current output that is required, each rotary is fitted with a remote controlled motor operated

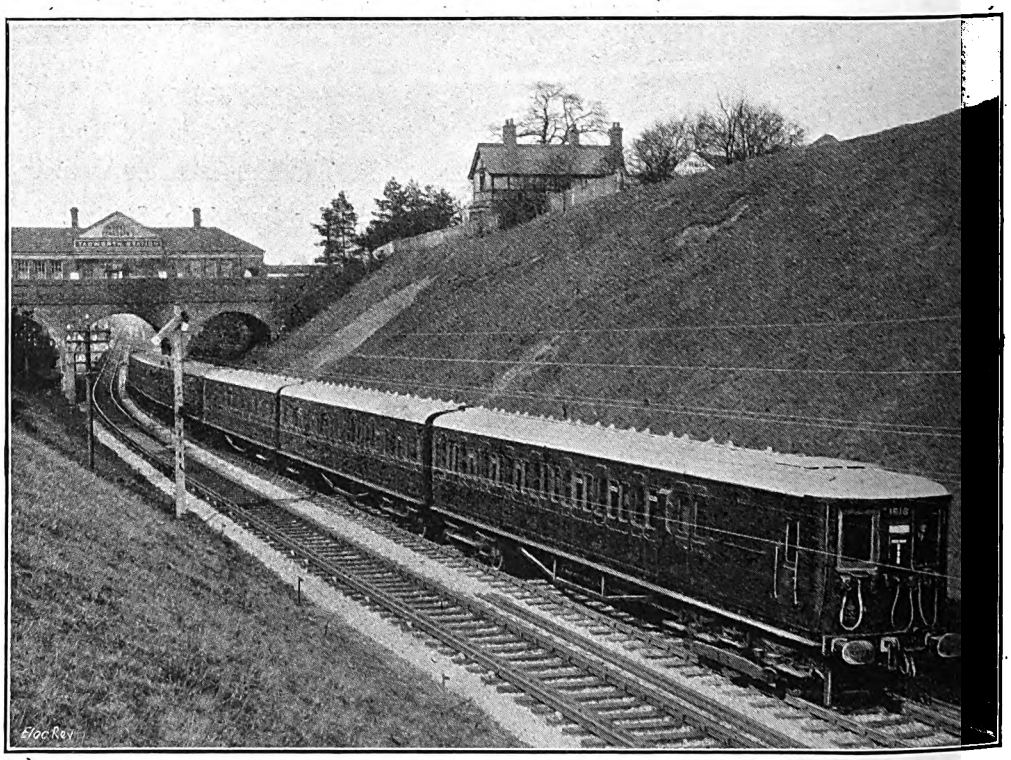

Fig. 9.—Tattenham Corner on Southern Railway.

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induction regulator and a hand operated field rheostat, giving a d.c. voltage range of 220/275 volts for electrolytic work, and capable of coming down to 190 volts for paralleling purposes.

Another notable recent machine that may be mentioned is a frequency changer installed by the London Power Co. This machine, which has a total weight of approximately 350 tons, has a rated capacity of 30,000 kW at 0.9 power factor, and is designed to run at 500 r.p.m. and convert from 11,000 volts, 25 cycles, to 6,600 volts, 50 cycles, or *vice versa*. By means of a super-excitation system and field-forcing, the set is designed to carry 3½ times its rated full load for short periods, in order to take care of temporary disturbances on either side of the system.

In electric winders one of the most notable developments of recent years is represented by the Harworth Colliery installation, of which the 14/26 ft. bi-cylindro-conical drum driven through gears by two 1,200/3,000-h.p. d.c. motors was illustrated in the Electrical Review for August 9th, 1929, p. 252. This installation is arranged on the "S.P. System," in which the winder motor is supplied from a special generating set which has a fly-wheel coupled between the d.c. generators and a high speed condensing turbine. The successful operation of the first set has been followed by its complete duplication for a second shaft.

Another winder plant, illustrated in fig. 3, has recently been installed in South Africa at the City Deep Gold Mines No. 4 shaft, and has the distinction of being the largest electric winding equipment in the world.

The winder is designed to raise a net load of 9¼ tons of ore from a depth of 4,500 ft., 31 times per hour. The motor is a double unit machine for operating at 32.7 r.p.m. and with a peak load capacity of 12,500 h.p. It is controlled on the Ward-Leonard system, and supplied with d.c. from two 2,000-kW generators driven by an induction motor of 5,200 h.p.

In applications of heavy electrical plant to machines employed in the iron and steel industry, the most notable installation completed within recent years is that of the Appleby Iron Works, of which two illustrations are given.

Fig. 11 shows a 6,000/15,300-h.p., 1,350-volt, d.c. motor driving a 42-in. slabbing mill, a duplicate motor being installed to drive a 10-ft. plate mill, and a similar motor, but of 5,000/13,300 h.p., being installed to drive a 7-ft. plate mill. The larger motors have a speed up to 100 r.p.m. in either direction, the corresponding speed for the smaller motor being 120 r.p.m.

D.c. supply for the three mill motors is obtained from two motor-generator sets, each consisting of four 1,500-kW d.c. generators, driven by a 3,000-h.p. induction motor, and each set having a 12-ft. dia. 38 tons weight cast-steel flywheel.

The two flywheel m.g. sets, together with the necessary excitation m.g. sets, are shown in the illustration, fig. 10, the 10-ft. plate mill motor being shown in the front and the 7-ft. plate mill motor at the back of the illustration.

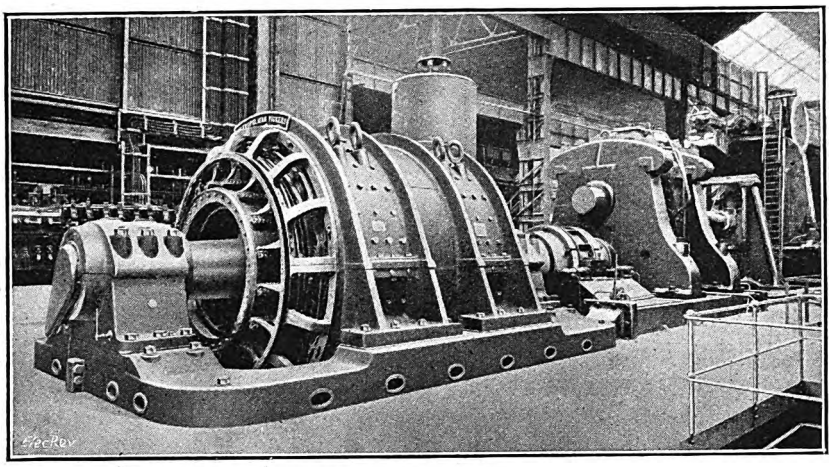

Fig. 11.—A 42-in. Slabbing-mill Motor.

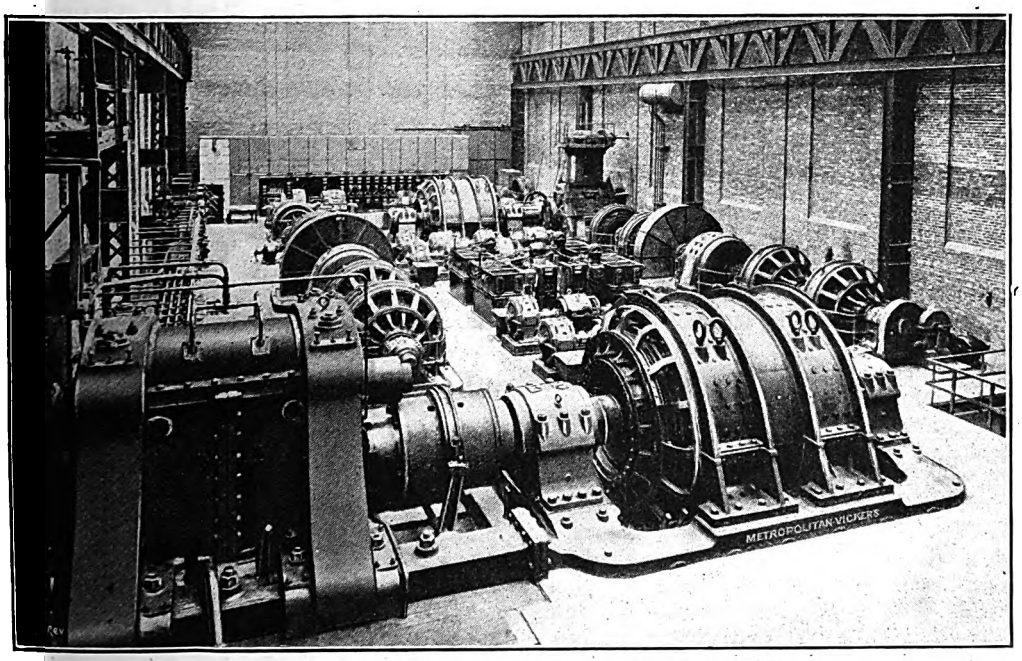

Fig. 10.—Large Plate-mill Motors.

For permission to use the accompanying illustrations, acknowledgments and thanks are due to the Metropolitan-Vickers Electrical Co., Ltd.

Flats on Steel Slip Rings.

Mr. W. E. Warner has sent us the following note on the formation of flats on steel slip rings:—

"Steel slip rings, in place of the more usual bronze slip rings, have now found an extensive application on alternating-current generators. These rings have the advantage of great strength, but have the disadvantage that their electrical and thermal conductivities are much lower than those of bronze rings. This renders them more liable to overheating and the formation of flats, which can be partly obviated by using well-fitting and well-bedded brushes.

"These rings may also tarnish rapidly, the film of tarnish increasing the electrical resistance of the rings. The film of tarnish is not uniformly distributed round the rings; the rings tarnish when at rest, but as certain parts of the rings are then covered by the brushes these parts, being protected from the atmosphere, do not tarnish. This causes the rings to have an unequal resistance round the circumference, which is conducive to the formation of flats. The tarnish can to a great extent be prevented from forming by applying a stick of paraffin wax to the rings just as the machine is coming to rest, thus protecting them from the atmosphere. When possible it is advisable to use lubricated brushes on these rings, as they cling to the surface of the rings better."

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Rural Electrical Development.

Some difficulties and a few suggestions for overcoming them, remembering that there is room for co-operation between those who desire to preserve the rural aspect of the countryside and those who are attempting to provide it with cheap power.

By W. FENNELL, M.I.E.E.

WRITERS are becoming as tired of writing as the public is of reading of the wonders being wrought abroad—always abroad—in rural development and electrification.

We are rapidly approaching the time when the rural public will be reminded each day, by the sight of the "grid" and the absence of electricity in their homes, that its presence on its countryside has no compensating advantage to the country dweller. We know it has been stated that the "grid" cannot be tapped for less than 10,000 kW, but up to the present time there has been no published layout of an adequate secondary system (33 kV) to provide bulk-supply points to deal with rural distribution areas. So far, the idea is to deliver electricity only to the bus-bars of existing power stations, large and small. The record of the Central Electricity Board is such that the author feels sure that something adequate will be done, and that this initial rural difficulty will be removed speedily. It is the fact, however, that even where a bulk supply is available the distributor has to fight the battle for the improvement of the conditions of life in the country with practically no help from anyone. Amenities are allowed to dominate the situation, and the wording of the overhead wayleave clauses of the 1919 Electricity Act encourages the assumption that overhead lines will spoil the countryside. If that were true, the discovery is fifty years too late. Our countryside is well furnished with overhead lines, the main roads, railways, and canals are fenced in by huge banks of them, with poles askew, complete with struts to hold them up; all fitted with dinky little white knobs, which shine in the sun and mark out the route for miles. Overhead lines are thus common objects of a presumably still beautiful countryside, like dilapidated cowsheds and Victorian cottages. At the present moment Post Office engineers are threading rural lines down every country lane and are putting their sentry boxes on every village green, and no one says anything about it. They are treated, not as malefactors, but as public benefactors by their Acts of Parliament.

Notwithstanding the 1919 Electricity Act, which dispensed with the consent of local authorities, giving them only the right of being heard, we still have as a matter of practice to ask local authorities for their approval. We put it as nicely as possible: "May we provide a new kind of line having neat vertical poles, brown and almost invisible insulators, and a mere three or four wires in order to provide rural inhabitants with many conveniences?" The fact of our having asked for their approval suggests that they may withhold it, and encourages them to think that they have only to obstruct sufficiently and we must give way. They have tolerated petrol pumps and telegraph poles, complete with struts and white insulators, but they often say they will not have overhead power lines and sit tight to see what will happen next. We are thus involved in a public controversy, our schemes are delayed, wayleaves are prejudiced by the infectious example of the local authorities, and overhead costs mount rapidly. It would be presumptious to suggest a remedy, unasked, but surely something better could be arranged, now that the Government really wants rural electrical development to be carried out.

There is also a widespread attitude of opposition by the town dweller with regard to rural overhead lines, which certainly does not assist in giving courage to the average electrical engineer, who is himself usually a product of town life. The cause of this opposition is possibly his recent discovery of rural England with the aid of the motor car. Rural England is not thought of by him as a food factory—it is visualised as a vague sort of garden, provided by the simple agriculturist; it has wide garden paths provided by a simpler county council for the urban population (not paying rates to the county) to perambulate in on Saturdays and Sundays, to take the air and leave their litter. We have a right to ask: "Does the countryside really exist primarily as the townsman's special park, or is it the home and works of the food producer?" The answer is that the country is only incidentally a playground for the fox-hunter, a game preserve for the "sportsman," and a public park provided without cost to the city dweller. It is primarily the home of a very large industry—agriculture—which is dwindling chiefly because conditions of life are too dull and uncomfortable to retain bright youths and educated adults capable of solving its problems.

Electric light, an electric motor in the farm buildings, an electric cooking stove, an electric iron, the provision of hot water on tap, and facilities for the charging of wireless accumulators, &c., make all the difference when the subject of the desirability of migration from country to town, or *vice versa*, is on the agenda. Under these circumstances it is clear that the provision of power for rural areas at a reasonable cost is necessary in order to ensure the existence of a high-grade population.

Any successful demand for underground mains, which increases the capital cost, by so doing increases the charges for such electricity supply, and is seriously damaging to rural England. This fact is not always understood by existing rural dwellers. It is rarely appreciated by those who talk of rural amenities, meaning only views of scenery, &c., that the internal lack of comforts and amenities should be an equally important concern of theirs. In short, it appears to be forgotten by all and sundry that *the only way to preserve rural England is to preserve agriculture*, and that a most important step in that direction is to make rural England on the whole attractive and profitable in competition with the towns. If agriculture continues to decrease, we shall have vast weedy wastes instead of a smiling countryside. If we can secure the recognition of these facts, our task will be eased to a wonderful extent, and it will be useful if this line of argument can be developed.

The writer wishes to suggest that there is a field for co-operation between those who wish to preserve the external rural aspect of the countryside and those who are trying to provide it with cheap power, heat, and light, so improving the internal amenities of country life. It might be possible to arrange consultations between the engineer responsible for the pole design and

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the route, and a qualified local representative of the Society for the Preservation of Rural England, at which an attempt would be made by the engineer to eliminate any harshness of outline or want of harmony with nature of his pole design, and to choose routes which would perhaps be almost as cheap as the one objected to, but hidden to a much greater extent from public view. In return for this consideration we might ask for help in obtaining wayleaves and in securing an easy passage through the local council. To secure that co-operation, we must bring forward figures to prove to the public that the total cost of overhead work is very substantially less than that of underground mains, and can provide a supply of electricity at a much lower price.

If any engineer has carried out even a small scheme of rural development (not suburban) by underground mains, it is important that he should publish his figures, because the question is put to us: "Is not underground work cheap enough?" In the absence of examples and figures, the answer to that is clearly to be found in the fact that those dealing with underground work have left rural work severely alone throughout the years they have had a monopoly. It was not until the overhead lines advocates made themselves heard that even talk of any rural development resulted. *Even overhead lines, however, are not cheap enough yet*, as is to be seen by the fact that "truly rural" development is not progressing quickly in England even by that means. The Government has, in fact, thought it necessary to carry out an experiment around Bedford to see if it can be done successfully.

Here the writer wishes to digress for a moment to point out that no distribution service can be given cheaply unless the capital cost per consumer is low in proportion to the traffic. With three consumers to the mile the capital must approach the same low level of five times the annual income, as where consumers are 30 or even 300 to the mile. The public will not be satisfied with rural electricity costing substantially more than in suburban areas. It is clear, therefore, that as one gets further away from the moderately populated areas, such as outer suburbs, which are being dealt with fairly well under the present standards of overhead work, the cost (and therefore the standard of construction) *must* be reduced, or the town and suburban dwellers will be subsidising rural electricity. The Electricity Regulations do not take account of this axiom; they impose exactly the same standards of cost on a 1-ph., 3,300-V, rural line as they have imposed on the 132,000-V "grid," which is really surprising, because even the railways have been allowed modification for rural lines. The Light Railways Act did for the rural railways what still remains to be done for electricity supply, *viz.*, allow a lower standard in thinly-populated areas where a high standard means direct or indirect subsidy, or the refusal of a desirable public service. Modification of the Regulations as applied to rural lines should enable us to approach the Continental and American standards of cost for high-pressure work. The writer urges that this means be considered in preference to that steep incline known as "subsidy." The Bedford subsidised experiment will be interesting, but unfortunately some unsympathetic politician may argue successfully from it that rural electrification is an expensive failure, and the whole movement will be injured seriously thereby.

(To be continued.)

The Distribution of Electricity in Scattered Areas.

Some suggestions relative to the reduction of costs, with special reference to the use of home-grown timber.

By JOHN A. SUMNER, A.M.I.E.E.

THE electricity supply industry is now approaching a condition which the science of economics would describe as being ideal. This condition is that due to the simultaneous awakening of the demand from areas popularly classed as "rural areas" and the reaching of a comparative saturation point in the central town areas, which are generally established by this time upon a financially stable basis. Thus, what may be described as the ideal condition has been reached of a demand arising just at the time that supply authorities have a surplus available. The result of the coincidence of supply and demand is seen in the manner in which areas hitherto unconsidered or undeveloped are being examined and delimited and, in many cases, are being supplied on a basis of demand which would, until quite recently, have been considered inadequate.

There is, therefore, taking place a careful consideration of the relative merits of overhead as compared with underground transmission and distribution, and the chief criterion in this comparison is that of the relative first costs of the two systems, followed by an examination of the relative annual costs. It may be stated at once that, in most cases, the important financial advantages which overhead lines show will usually over-rule the æsthetic and similar objections that are often put forward.

This, therefore, leads us to the first method of keeping the cost of rural supply to a minimum and of reducing annual charges, the use of overhead lines.

Overhead lines need not always be unsightly, although too often it occurs that insufficient care is taken in surveying alternative routes, and as a result the advantage which wooded and semi-wooded country offers for reasonable concealment and natural setting of the line is disregarded altogether. The writer can quote several cases in which representatives of local authorities, who have strongly but unsuccessfully opposed the erection of overhead lines on æsthetic grounds, have gratuitously and publicly revised their opinions and withdrawn any opposition after viewing the lines, which have been made to conform as far as possible with natural surroundings.

The problem of successful rural electrification, with its scattered and thin demands, is essentially one of reducing capital charges to a minimum. The full consideration of this problem would embrace a very wide subject, but there are two broad and obvious solutions available. The first is that of bringing the cost of rural distribution and transmission lines to the lowest figure, and the second is to ensure, without limit-

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ing the consumption, that the load factor of a line or system is kept as high as possible. Such desideratum would appear to be a common-place, and is, of course, highly desirable for any system. For this reason it is necessary to emphasise strongly that the diversity of demand in the town is very much better than in the rural areas, owing to the varying types of demand incidental to any large community of people having their diverse industries, &c., a fact which, whilst obvious, does not seem to be fully realised.

The reduction of the cost of overhead lines would be greatly facilitated if some greater measure of standardisation were arrived at. Such a statement is particularly true as regards line supports, the design and classification of which are wastefully un-co-ordinated. Management and overhead charges are consequently very much higher than need be the case, and no manufacturer can possibly undertake the construction for stock purposes of steel, concrete, or any other form of support, owing to the large number of specifications which are existent, varying over a wide range and hardly ever duplicated. So far as the writer can see, there appears to be no serious obstacle to the standardising of lines capable of carrying, say, from a minimum of 50 kilowatts to, say, 5,000 kilowatts.

It is realised that to some extent the local requirements will often determine these features, as, for example, in the case of a low-pressure distribution line feeding a row of dwelling houses built in "ribbon" fashion. Yet these difficulties could be overcome, and the values obtainable by some method of standardisation of supports and of relevant line features are not less than those already obtained in many other branches of construction in the electrical and allied industries, which have a system of standardisation and large-scale production of an article as a corollary to the low cost of that article.

The increasing use of English-grown timber supports is, in the writer's opinion, the most important current method of reducing costs, especially for distribution and light transmission lines. The most important feature influencing the small cost of this material is that there is, as yet, no general demand other than for line work for English spruce (or for the Scots pine, which is so eminently suitable for line supports). Yet a very moderate estimate of the number of such trees now growing in forests, planted and preserved by H.M. Forestry Commission, shows that at least one million trees, complying with the standard dimensions and strengths requisite will be available for use within the next 10-20 years. This figure was obtained after allowing for subsequent thinning, rejects, &c., and does not presume any special growth or consideration for the demand for overhead-line supports. The writer has recently obtained and superintended the treatment and erection of more than two hundred English poles, obtained from local sources and also from H.M. Forestry Commission at a saving in cost of more than 60 per cent. Their appearance, especially those from the latter source, are quite comparable with that of imported poles. The question of specially planting and growing for overhead-line demands is now undergoing serious consideration by the above Department. It may perhaps be explained that the growth of spruce timber involves four intermediate periods of thinning and felling. For three of these operations there is an established demand for the product, but at the third thinning stage, when the trees are of the correct size for normal line work, there has been, to the present, no demand at all. For this reason English spruce timber for line supports should be relatively cheap, owing to the trees at the third stage at present constituting something in the nature of a wasteful by-product.

The second consideration influencing the costs of rural electrification, *considered separately as such*, implies a careful appreciation of the special nature of the rural demand. In many cases the rural area is an adjunct to a previously established central town area; the load factor of the latter area is generally good, due to the normal power and other day demands which are common to a collection of industries comprising a "town." Where a large undertaking is supplying in such a town area, lighting, heating, and cooking demands represent only a very small fraction of the total load.

But in rural areas consumers with these demands represent the main load, and consequently produce a poor load factor. The conditions will be greatly altered only when a more full appreciation is given to the possibility of supplying the "load on the land," such as ploughing and its associated operations. In the meantime, however, the unrestricted use of heating and cooking, more especially on a low tariff, and with the present design of apparatus, is not conducive to economy, nor is it a paying load for the average undertaking. The influence of the lighting load upon the rural (and town) system load factor is appreciated and met by the adoption of a high average rate per unit for such use. The consumer with, say, 0.2 kW of lighting demand will rightly be expected to pay such an amount annually as will ensure a reasonable return on the annual maximum demand portion of the undertaker's expenditure. Yet the use of a consuming device with a high demand, such as, say, a 3-kW radiator, is quite likely to be coincident with the peak load, and for occasional use (as is too often the case) such apparatus often has an individual load factor which is less than that of a drawing room lamp. The radiator will then have an adverse influence much greater than that of the small lighting load mentioned, whereas it is common practice to offer a very much lower tariff for the former use. An equally, if not more important, factor than this influence of the heating and cooking load upon the station or bulk supply demand portion of the capital charges is that of the annual cost of copper in the line and transformer, since rural electrification presumes high voltage distribution, the annual cost of which will be high, due to the scattered and wide demands. It is for these reasons that the suggestion is made that a specially low tariff for such uses as heating, &c., cannot at present be economically considered unless and until very considerable development has taken place in definitely "off peak" loads, the foremost of which is the load resulting from land tillage operations.

We thus reach a position at which some clear-cut definition must be made of the meaning of the term "rural electrification." One standard definition states that a "rural area" is "an agricultural area distinct in details from a town or city area." If we include in this definition the term "suburban," we arrive at the real definition for the present stage of social development. A rural area presumes a very sparse population and widely scattered houses. Such a condition makes it necessary to consider and commence development at the stage at which the early town development began. Lighting and heating, and in fact all the normal domestic uses of electricity, can only be supplied at a cheap rate as the power "off peak" load is developed. At the moment this power load is of prime importance, because, until the existing "valley" which occurs in the load curve between successive hours of darkness is filled in, the more ideal conditions found in the fully developed town load can never be realised. In the meantime, all means which will accomplish the cheapening of supply and distribution should be strongly encouraged and sought after. Standardisation, the initial planning of a basic rural distribution system which is adhered to, instead of extensions being allowed to spread haphazard and by fortuitous development, and the planning of this system so as optimistically to include the possibility of supply to any point on the land for power purposes, the development of low demand and long-hour use types of apparatus, and finally a greater insistence upon the need for the encouragement of electric ploughing and its associated operations; only by such means will rural development proceed apace and take its place as has the already well developed and successful town and city supply.

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An Impetus to Rural Electrification.

Some practical comments on electric ploughing and the impellent needed to stimulate the general use of electricity by the farming community.

By THEODORE STEVENS, M.Inst.C.E., M.I.Min.E., M.I.E.E.

WHEN two years ago the attempt to put rural electrification more prominently before the country than it had been placed in the Electricity (Supply) Act of December, 1926, was initiated the formula which was later embodied in articles for the Overhead Lines Association was as follows: "To assist in making available with reasonable promptness, in every home throughout Great Britain, an abundant supply of electricity, and generally to adopt any course of action that the members may consider beneficial, and particularly by facilitating the erection of overhead lines, which are the only economical means of achieving that object in areas not very densely populated."

Villagers are not slow to appreciate the advantages of electric lighting, nor are farmers who have been fortunate in having electricity available. Is it reasonable to expect farmers and villagers without supplies to voice a demand? They would, if they could know what advantages it possesses for their convenience and profit. Where electricity is fully available at least 85 per cent. of the homes are consumers, but farmers cannot be expected to acquaint themselves with electricity until it is at their doors; further, under present conditions in British agriculture, the individual farmer is in no position to venture capital in what, to him, are experiments. There is no shadow of doubt that when he comes to use electricity his work will be facilitated, his production cheapened, and his output increased.

Valuable publications[1] exist describing the uses made of electricity on New Zealand farms, also in America, Sweden, and other countries, but what the individual farmer needs is not particulars of the hundreds of thousands using millions of kelvins per annum which appeal to supply authorities, but more specific details of what he personally could use to his economical advantage on his own farm.

Electricity suppliers were asked in September last to furnish to the Overhead Lines Association details of the consumption of electricity on farms in Great Britain in 1928. From the returns so far received 5,750 kelvins in the year is shown to be the largest consumption on one farm.

The Association undertook the compilation of as full details as are obtainable of the following items from each supplier:—

NUMBER OF KELVINS:—[2]

1. Maximum supplied in the year to one farm.
2. Average supplied in the year to all farms.
3. Minimum supplied in the year to one farm.

NUMBER OF FARMS:—

4. Supplied with electricity.
5. That might take supplies *from existing mains.*
6. In each area of supply.
7. To which electricity is supplied for light only.
8. Using other appliances in the house (to be listed).
9. Using light in cowsheds and stables.
10. Using light in barns.
11. Using light in dairy.
12. Using electric power in dairy.
13. Using electric power for feed cutting and grinding.
14. Using electric power for crop drying.
15. Using electric power for wood cutting.
16. Using electric power for threshing.
17. Using electric power for water pumping.
18. Using light for poultry (overtime feeding of hens).
19. Using electric heating for water.
20. Using electric incubation.
21. Using electric power for horse-clipping and sheep-shearing.
22. Using electric power for stacking hay, &c.
23. Using electric power for crop loading.
24. Using electric power for ploughing.
25. Using electric power for cultivating.
26. Using electric power for repair shop.
27. Two farms have tried electric ploughing.[3]

For individual farms there will be particular sizes of each detail suited to local requirements; but on every farm there should be the elementary conveniences that some wiring contractors appear to intentionally neglect, such as switching stair lights "on" and "off" at every and any floor; and of stable and barn lights at any and every entrance; also sockets for the use of portable lamps wherever animals sleep, so that in the event of sickness ample light will be instantly available.

In stables with low ceilings "bulkhead" fittings fixed to the ceiling give horses the least opportunity to bite the fitting, and rotating switches, if they must be inside, are freer from interference than those of the usual reciprocating movement.

The most important consumption of power on the farm is for ploughing and cultivating. If these operations are speeded up, simplified, and provided with capacity to increase tractive effort when desirable, it is obvious that the economy of time and cost will be very considerable.

Ploughing without horses is done in all parts of the world[3] using more or less elaborate systems of ropes with anchored pulleys, the outfit involving too high a capital cost for one farmer to own it. One outfit owned by a contractor requires several men to operate it and can plough a vast acreage in a year, but the time for ploughing any particular farm must depend upon the contractor and must be fixed well in advance, even before the farmer is certain of the exact conditions he may have to contend with as to weather and hindrances beyond his control.

An ideal equipment would be of such a size and cost that one farmer could own it, and he would thus be able to suit his personal conditions and convenience when he used it.

Incidentally, an electric motor does not lie down like an engine when it is overloaded. The electric motor has the capacity of the power house behind it and, within limits, it will carry an overload with only an increase in temperature.

(*To be continued.*)

[1] Publications of the National Electric Light Association:—"Developing Electric Service on the Farm" (No. 289/12. 25 cents.) Out of 50,000 Wisconsin farms, averaging 125 acres, 7,300 use electricity. "American Design of Rural Lines" (No. 289/16. 40 cents.) "Building the Load on the Farm" (No. 289/61. 40 cents.) 400,000 farms in U.S.A. are supplied by electricity companies. 450, each of whom paid, in 1927, for more than 3,000 kelvins, have names and addresses stated, but only ten of them state acreages, which vary from 80 to 346 acres, and average 7,300 kelvins in 1927. "Overhead Systems Reference Book" (592 pp., in I.E.E. Library, $7.50).

[2] We commend the use of the word "kelvin," which means one kWh of electricity, because we have almost an infinite number of other "units," by which we measure all the diverse things with which we have to deal.

[3] See ELECTRICAL REVIEW, p. 113, January 21st, 1927. Illustrated description of Italian "Fowler" system, using two electric locomotives and a four-furrow balanced plough, three men ploughing 8 acres in 10 hours.
ibid p. 607, October 16th, 1925. On average land a day's work for one ploughman and two horses is one acre.
ibid p. 209, 1927. Editorial, and Major McDowall on "Rural Electrification and Agriculture."
ibid p. 607, 1925. Nucleus of scheme in Cheshire.
See "Electro-Farming," p. 275, February, 1928. Illustrated description of stationary motor rope-hauling a plough at Greater Felcourt, East Grinstead, Sussex.

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Overhead-line Construction.

Some typical examples of Aerial Electric Power Transmission and Distribution Lines and Manufacturers' Notes on their Component Parts and Associated Equipment.

ALTHOUGH only doing so individually in insolated instances at the moment, not many years hence all dwellers in the country will be collectively demonstrating their indebtedness to the men who will have made supplies of electricity available to them cheaply, and who will thus rank high in the roll of benefactors of the rural population.

That honour should be bestowed upon the living is contrary to precedent, and is the greater for it. Eventually the industry

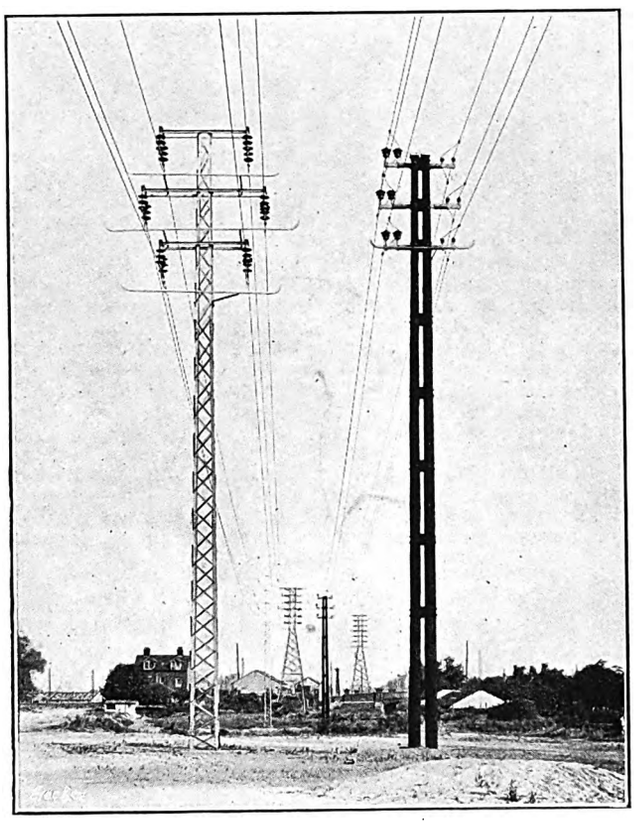

Fig. 1.—General View of "J. & P." Line.

at large will bask indirectly in the warmth of the acclaim, for without the farsightedness, the money, and fearlessness of the few who pioneered and guided the original effort to reduce the cost of distributing power electrically in rural areas by means of overhead conductors, the aim of making supplies of electric light, heat, and power universal throughout the British Isles would have been of little avail.

This is supposed to be the machine age. The engineer, practical idealist, being responsible for so much that *is*, cannot shirk his responsibility for the correct guidance of what *shall be*. Is no social problem involved in city building, in the continued movement of the population from the rural regions to the urban, with all its attendant evils, and has the engineer no concern in it? In addition to "directing the powers of nature for the service of man," he now adds to the common welfare also in fields more human, and finds himself occupied at times in social guidance, so that the tools he has provided shall be properly used.

The engineer's appreciation of his fellowmen's need of a life less burdensome, more healthful, and more worth while directs his efforts to relief: a notable trend is the spread of electric power into areas away from congestion, thereby permitting at least partial decentralisation of industries and population; a further material aid is the extension of electricity distributing lines into country regions, so that modern methods can be applied increasingly to agriculture, both in the field and in the agricultural worker's home.

Aerial Cables.

This modern trend, actively encouraged by the enterprising Overhead Lines Association, is increasing, having been largely assisted by the use of overhead lines, in place of comparatively costly underground cable, consisting mostly in this country of bare copper and steel-cored aluminium conductors, though iron and steel wires have been used occasionally. It may be pointed out, however, that insulated aerial power cables have their uses; they afford such a simple means of adding capacity to transmission lines, of repairing open-wire circuits without shutting down a whole line, and of relieving crowded pole tops. They are often the best means of taking on heavy power loads, of bridging gaps in system expansion, and of postponing underground or other impending changes, while for joint occupancy of poles, complicated crossings, and other specific uses they are very convenient.

Johnson & Phillips, Ltd.

An interesting contract for the erection of two overhead transmission lines for the Ipswich Corporation was recently carried out by this company. Starting from the municipal generating station, the only route available for the lines was along the river, which meant many angles and difficult foundations; moreover, the layout was further complicated by the large number of crossings which had to be negotiated. The route plant (fig. 4) shows the first 16 spans, and it will be seen therefrom that in that short length of 1,800 yards there are: six large angles, four road crossings, one railway crossing, four river crossings, four power-line crossings, one Post Office

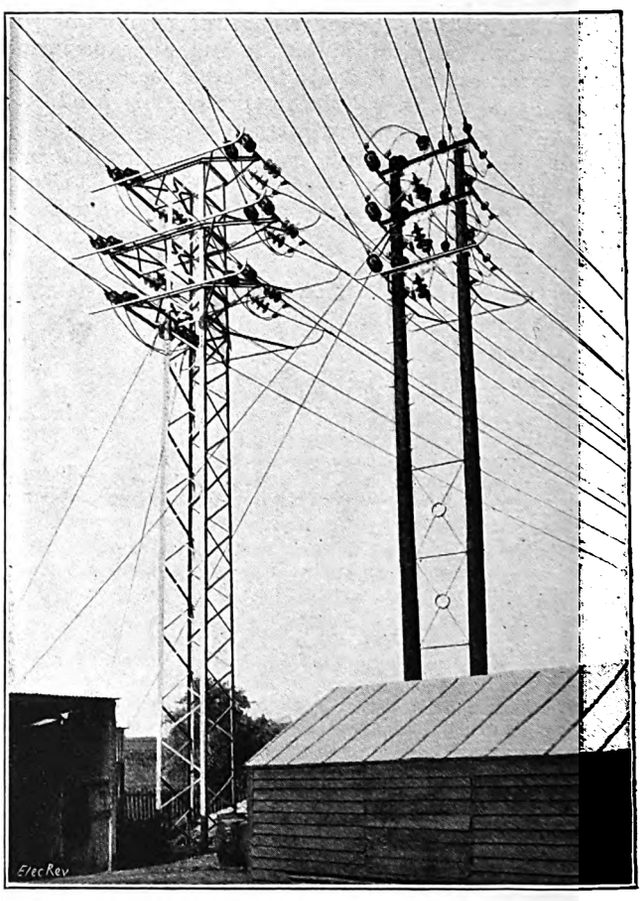

Fig. 2.—Line Guarding at 60-deg. Deviation.

line crossing, and one tramway trolley-line crossing. As a consequence, only four towers out of the sixteen did not need guarding or involve large angles.

The two lines are erected about 20 ft. apart. One line is a

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double circuit, 0.15 sq. in. equivalent steel-cored aluminium, for 33,000 volts working pressure, erected on 44,000-volt suspension insulators on steel towers; this line carries a bulk supply to the East Anglian Co. for its Stowmarket area.

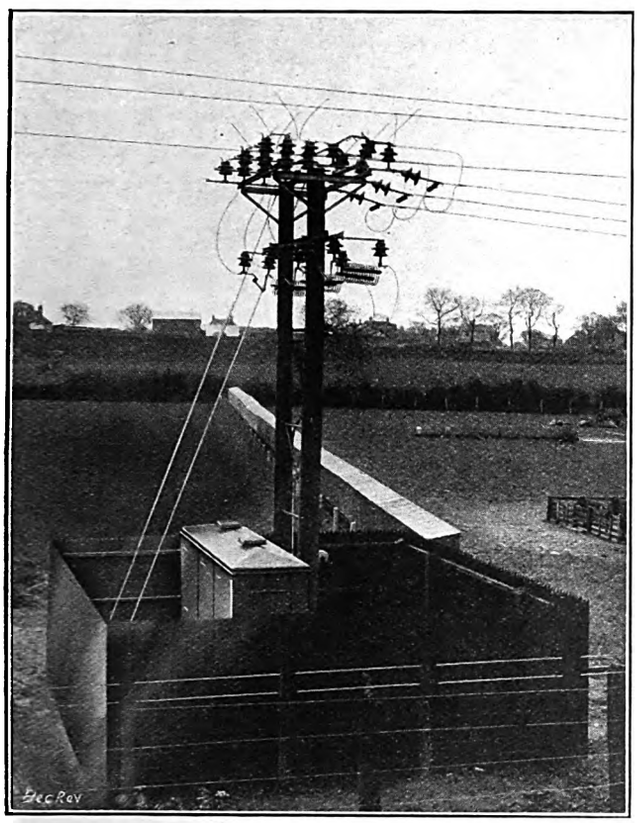

Fig. 3.—Kiosk-type Outdoor Sub-station.

maximum working tension of 3,693 lb. The 0.15 sq. in. ones were pulled up to 4,000 lb., this figure being adopted so as to avoid excessive loads at the many angles. The work was carried out to the instructions of Mr. A. S. Black, M.I.E.E., the Corporation's electrical engineer and manager, and under the general supervision of his mains engineer, Mr. Edge.

The " A.2 " 3,300-volt, " K.C." 6,600-volt, and " K " 11,000-volt automatic circuit breakers made by Messrs. Johnson and Phillips for pole mounting (fig. 6) are particularly useful when cheap oil-switch protection is desired, such as on rural lines. They have been used largely in the Colonies and the U.S.A., and are now beginning to be employed in this country. They can be connected to the transmission lines by means of live line connectors, which can be operated by a pole to disconnect the circuit breaker from the line for inspection purposes.

The company's bomb fuse (fig. 7) is for use outdoors on pole lines; it is easily and cheaply rewired and capable of rupturing a reasonably large power. It is made in three patterns, horizontal, vertical, and underhung for various ways of mounting, and for from 11,000 to 33,000 V. It consists of a heavy brass explosion chamber attached to a length of stout Bakelite tube, the inside of which is thickly lined with a special porcelain cement. The fuse is supported on a metal carrier fitted to a pin-type supporting insulator, and is easily removed for re-wiring. To ensure good electrical contact between the fuse and the supporting bracket to which the line is attached, a spring contact of the finger pattern is provided in addition to the metal clamp grip which surrounds, and makes contact with, the explosion chamber. Ordinary lead fuse wire is threaded through the tube and connected to a screwed plug in the end of the explosion chamber; air space between the mouth of the tube and the outside contact of the fuse wire provides a clear gap in the circuit after the fuse has blown. The action of the fuse when blowing is indicated by its name, *i.e.*, an explosion takes place within the chamber and the gases shoot along the Bakelite tube and out through the mouth.

Fig. 3 shows an " H "-pole with switchgear equipment, the oil-immersed circuit breakers, instruments, &c., being accommodated in the kiosk shown at foot, and the outdoor type transformer standing near by. This is an excellent example of the advantageous use of the sheet-steel kiosk in conjunction with overhead lines, the kiosk enabling a variety of gear to be inexpensively housed, and thus allowing large capacity cir-

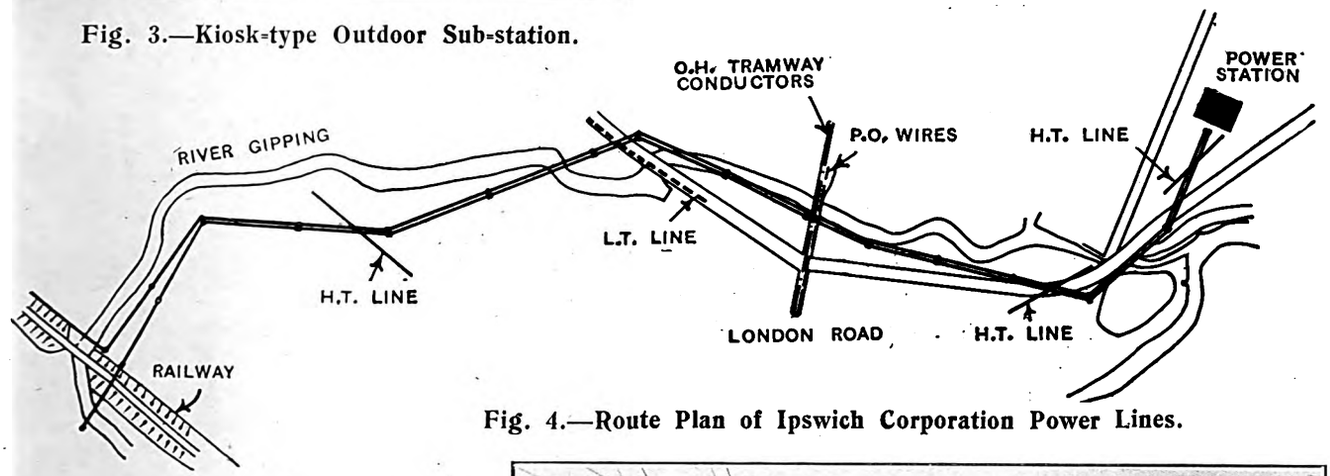

Fig. 4.—Route Plan of Ipswich Corporation Power Lines.

The other line is a double circuit one, erected on Rutter and " H "-type poles with 0.1 sq. in. equivalent steel-cored aluminium conductors on pin insulators; one circuit carries a bulk supply to the Woodbridge E.L. and P. Co., and is designed for 33,000 volts working pressure, while the other circuit supplies an outlying sub-station at 6,600 volts.

The towers range from 54 to 72 ft. in overall height, and the wood poles are slightly shorter on account of the pin insulators. The spans vary considerably, but the towers and poles have been designed for 450 ft. normal spans. Fig. 1 is a general view along the 33-kV line, and shows the lattice steel and Rutter poles arrangement adopted for a straight-line road crossing; the guard consists of duplicate insulators, bridles, and earthing brackets. Fig. 2 shows a 60-deg. deviation, with guarding on both sides, of 33-kV steel-cored aluminium lines. Fig. 5 shows an interesting type of tower which has been used for crossing the main London road, at which point the four circuits are brought together and carried on the same towers, which are 71 ft. tall overall. As there are tramway and Post Office conductors along the road, a seven-wire cradle has been erected, and the towers therefore carry nineteen wires in all, and present a very fine appearance. The 0.1 sq. in. conductors were pulled up so as to give a

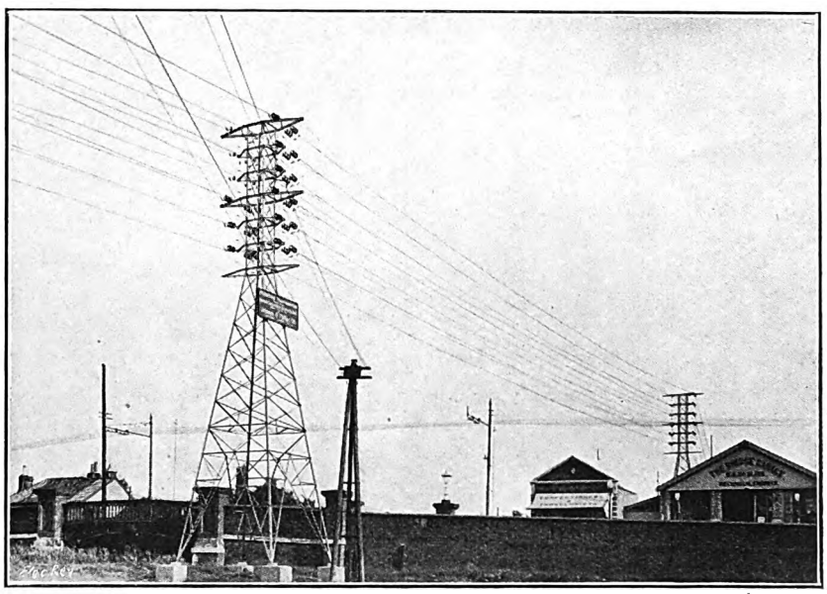

Fig. 5.—London-Ipswich Road Crossing.

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cuits to be dealt with without the expense of a built substation. Should the load grow, or its distribution alter, necessitating other arrangements, the kiosk can, of course, be readily moved elsewhere. Small transformers can naturally be housed in the kiosk with the switchgear, and the warmth thus generated assists in preventing the condensation of moisture.

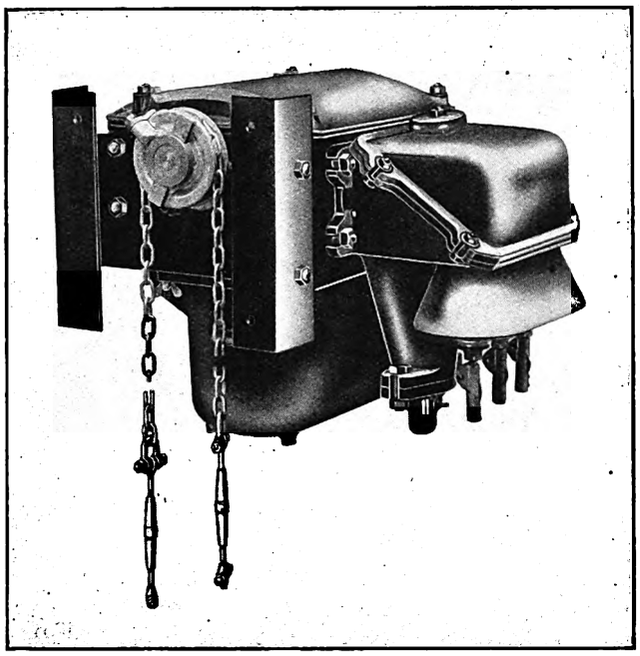

Fig. 6.—" J. & P." Pole-mounting Circuit Breaker.

British Insulated Cables, Ltd.

The photographs reproduced as figs. 8 to 10 illustrate the revised design of construction that the B.I. Co. is employing in the case of some of the new power lines which are being erected in Bedfordshire. The company emphasises its claim that bird trouble should be eliminated entirely, owing to the fact that the arms are set at an angle at which there is not room for a bird to perch anywhere near the line wires. Particular attention is directed to the beam pole (fig. 8), which, it is thought, all will agree is exceedingly neat in appearance, and it is of course made of steel throughout. A new service clamp, or line tap, which the B.I. Co. has recently introduced (provisional patent No. 15,851 of 22/5/29) is illustrated in fig. 11. It is made of wrought copper, and is intended for taking a branch service conductor off an overhead line. The clip has been designed to have a conductivity 100 per cent. of that of the branch line.

Pirelli-General Cable Works, Ltd.

The crossarm shown in figs. 12, 13 and 14 forms the principal feature of the standard rural line construction developed by Pirelli-General Cable Works, Ltd., an associated organisation of the General Electric Co., Ltd., and has been employed with success for both copper and steel-cored aluminium conductors. The whole fitting is made from a single length of channel section, and combines a solution of the bird problem with a construction that is economical in pole height, immune from leakage troubles due to broken binders, and easy to bond effectively to the earth circuit. Good appearance has also been studied, whilst the employment of the edges of the channel section to grip the pole results in a very firm attachment without the necessity for notching, or unsightly straps. A complete range of standardised fittings and pole arrangements has been developed to meet the requirements of rural lines in an economical manner, special attention having

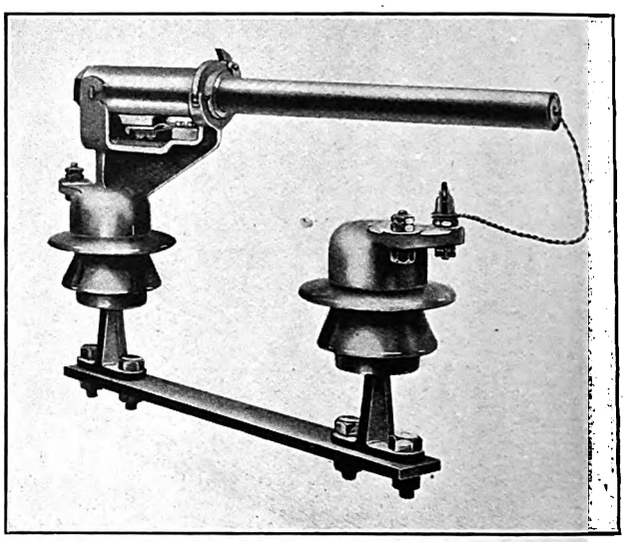

Fig. 7.—" J. & P." Bomb Fuse.

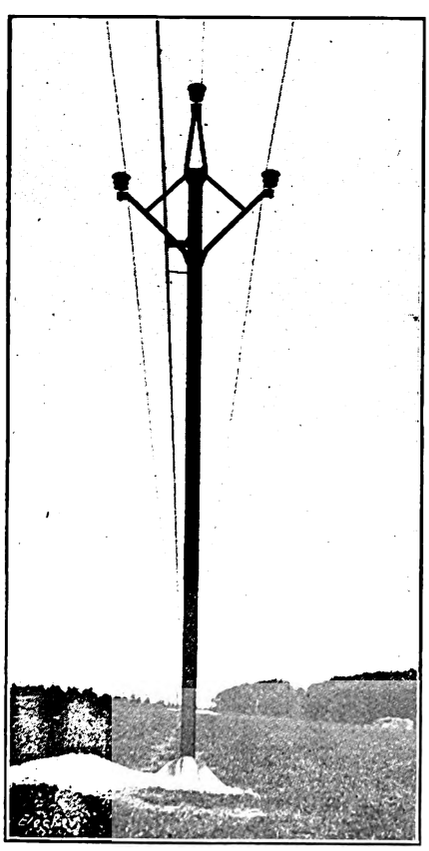

Fig. 8.—" B.I." Beam Pole.

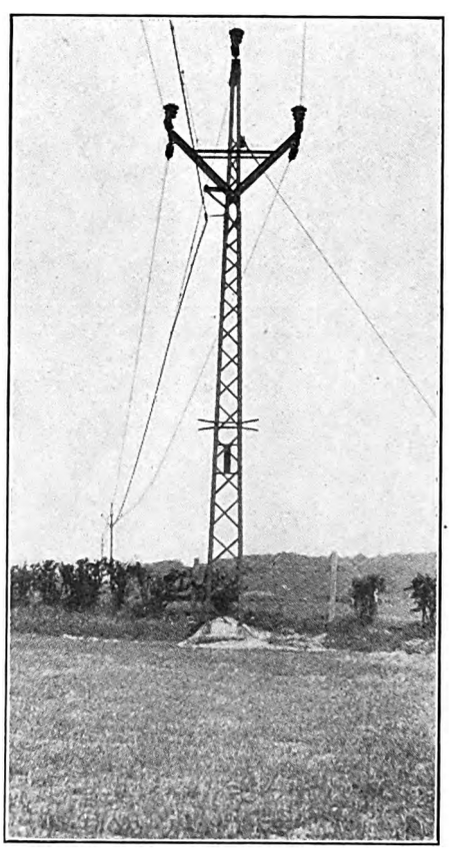

Fig. 9.—" Bird's-foot " Pole.

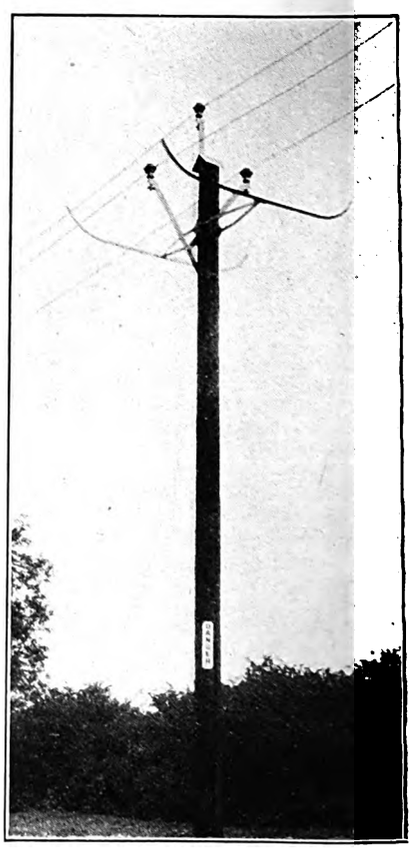

Fig. 10.—Guarded Pole.

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been given to reducing so far as is possible the number of different fittings required, and extending their range of application wherever possible.

A double-circuit 33-kV steel tower line has recently been constructed by the Pirelli-General Cable Works, Ltd., under

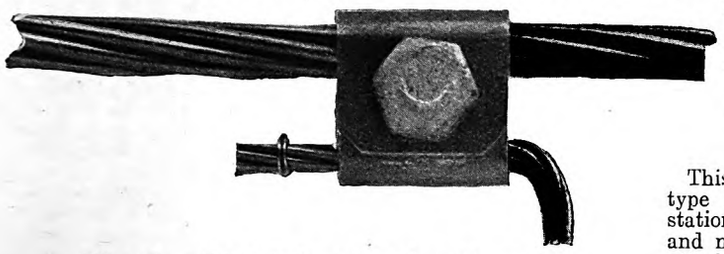


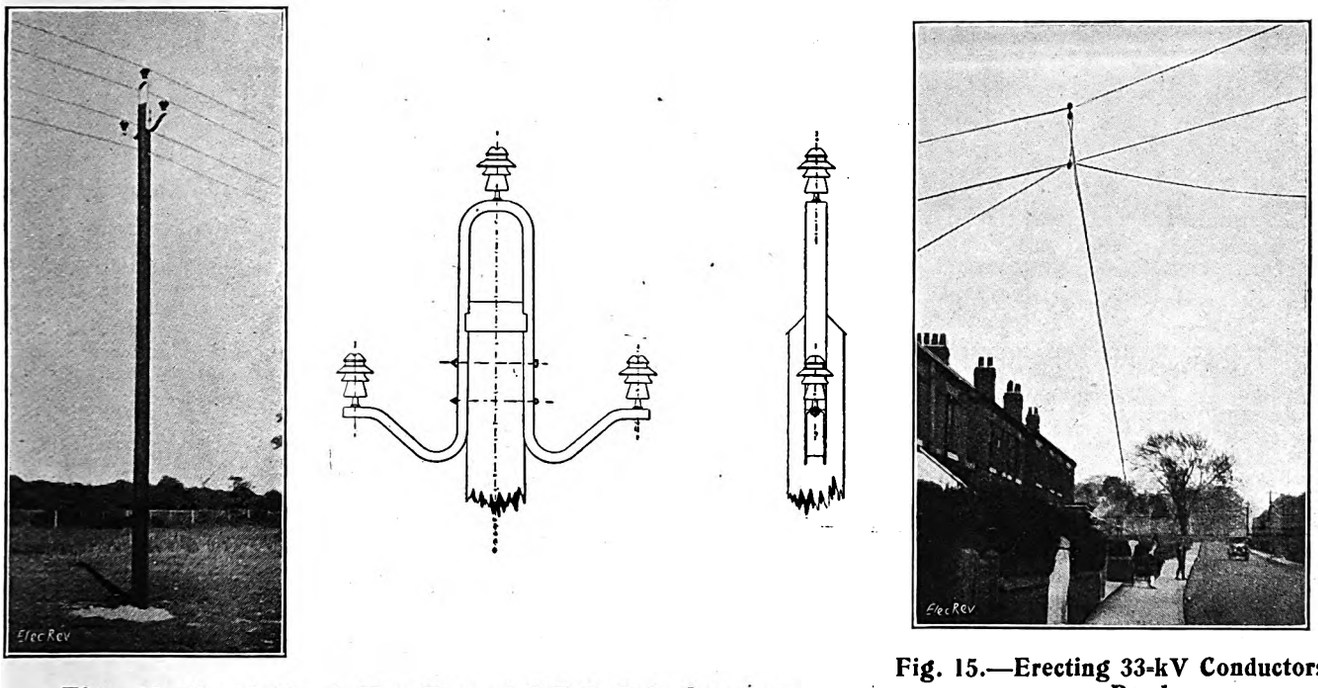
Fig. 11.—"B.I." Service Line Clamp.

a contract which was placed with the G.E.C. by the Central Electricity Board; various views of the line are reproduced in the accompanying illustrations.

The line has normal spans of 700 ft., and consists of steel-cored aluminium conductors supported by three unit insulator strings of the cap-and-pin type carried on galvanised steel towers, which are of the narrow-base design at the straight line positions (fig. 16), which shows a long span up to a hill-top tower) and of the wide-base design in the angle positions (fig. 17). The stubs of all the towers are encased in concrete at the ground level to provide additional security against corrosion. All the towers were built up on site from separate galvanised members, as it was found more economical to adopt this method than to assemble them on the ground and subsequently swing them into the vertical position; the former practice also minimises the disturbance of land and crops. Duplicate insulators and earth wires are fitted at road crossings (see fig. 18) in accordance with the Electricity Commissioners' regulations, and large independent cradle guards are provided where the line crosses trunk telephone lines of the Post Office. At one point the line also crosses a street of dwelling houses, the erection of line conductors over which is shown in fig. 15. Several special towers were necessary, for instance, at a point where a branch line is looped in on one of the circuits.

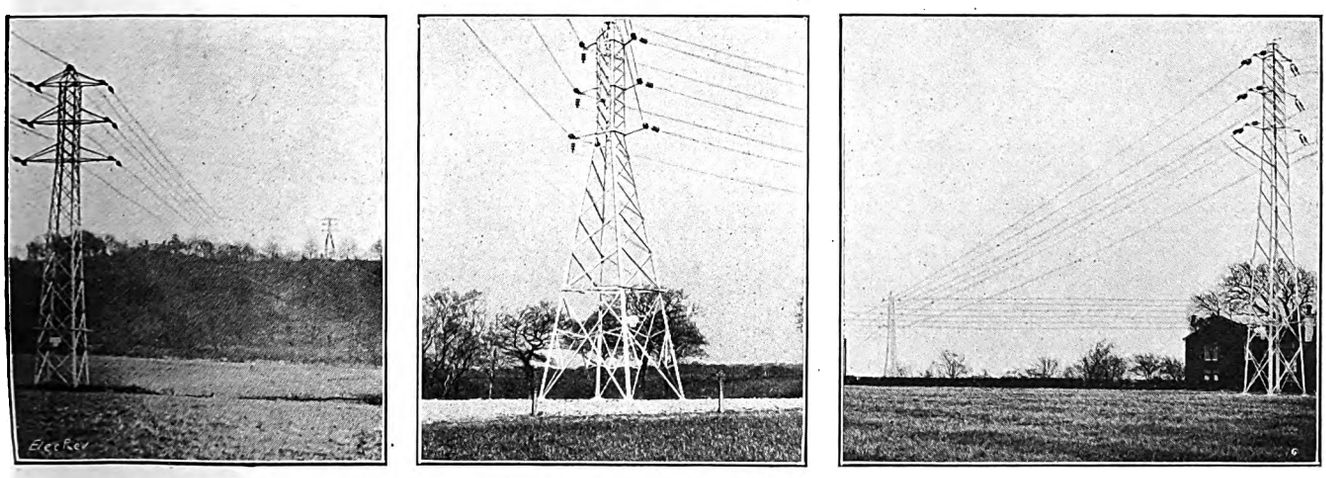
Metropolitan-Vickers Electrical Co., Ltd.

This company has developed a form of outdoor fuse-switch, type FS, for the control of small outdoor transformer sub-stations on overhead transmission systems. It consists of fixed and moving portions mounted on framework suitable for attachment to an H-pole structure carrying the transmission line. The moving section comprises three porcelain fuse carriers mounted on a common crossbar and fitted with main and arcing contacts for engaging with the fixed section. The fixed contacts are mounted on standard outdoor pattern pin-type insulators, which in turn are carried on a suitable framework. Arcing horns are fitted to the upper contacts so that the circuit can be broken under load. The fuse carriers are wired in a similar manner to standard low-voltage porcelain fuses, and when the fuse wire melts, the fuse operates with an expulsive effect, which blows out the arc formed in the carrier. The fuse-switch is operated by a long insulated handle reaching to normal level, and provision is made whereby the handle can be locked to prevent unauthorised operation. The switch has three definite operating positions, *viz.*, closed, open (fig. 20), and re-fusing (fig. 19). To obtain the latter position, the handle is manipulated to release a catch, when the



Figs. 12, 13 and 14.—A New Type of G.E.C. Pole Cross-arm.

Fig. 15.—Erecting 33-kV Conductors over Road.



Figs. 16, 17 and 18.—Pirelli 33-kV Line Erected for the Central Electricity Board.

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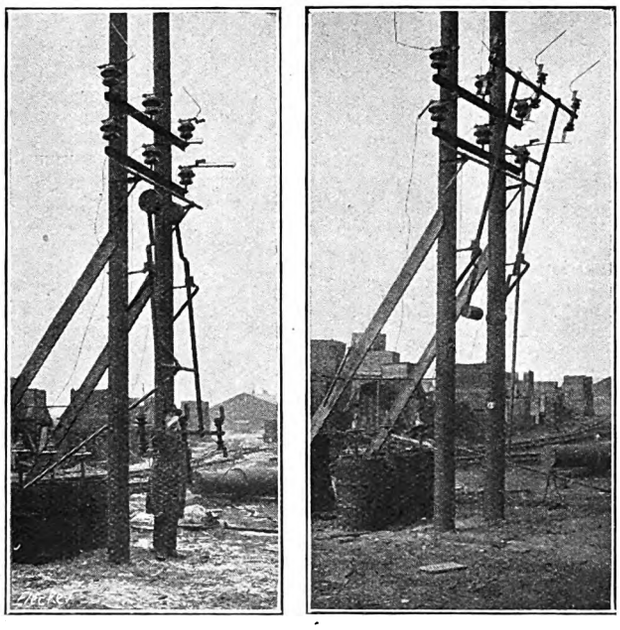
moving element can be lowered to the ground level, so that the rewiring of the fuse carriers can be done conveniently by the operator without danger from the live conductors. The moving section is pivoted at a central point for this purpose, and is balanced, so that no great effort is required to raise and lower the moving element. All iron framework is hot-dip galvanised, which is the company's standard practice. These switches are made in 50-amp., 7,500 to 37,000-V, 3-pole sizes.

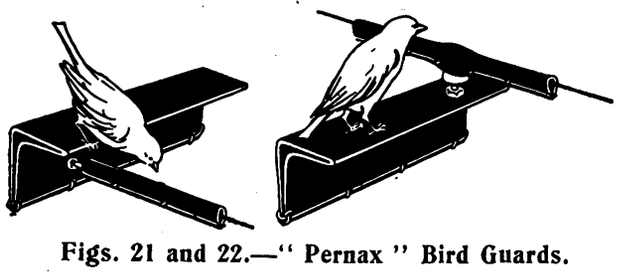


Figs. 19 and 20.—" Metrovick " Type-FS Fuse-switch in Re-fusing and Open Positions.

The company's type-VU air-break switches for use at pressures up to 154,000 V are designed for remote control, usually mechanically, although electrical operation can be provided if necessary. The switches are made single-throw only, and may be assembled as double- or triple-pole units; the blades move vertically, the motion being obtained by rotating the end insulator on each pole. By this means a considerable saving in space is made, as the poles can be placed at centres corresponding to the spacing of the line conductors and no increase of these dimensions is necessary to allow for any horizontal move ment of the switch contact.

Croydon Cable Works, Ltd.

Besides wires and cables, this company manufactures " Pernax," a very useful compound that is employed for insulating cables to withstand severe conditions and for protecting metal-sheathed cables from attack; it can also be formed into rods and tubes, cross arms, bird guards, &c., for overhead



Figs. 21 and 22.—" Pernax " Bird Guards.

lines. It is made of pure para rubber and compounded with waxes, no sulphur or other corrosive ingredient being used. It has a dielectric strength of 1,000 volts per one-thousandth inch, will not crack with vibration, and seems to be permanently water- and weather-proof, non-corrosive, and unaffected by exposure, being also tough. " Pernax " overhead-line bird guards are illustrated in figs. 21 and 22.

" Copperweld " Wire.

One of the functions of overhead earth wires in high-voltage overhead transmission is to improve the reliability of the line by protecting the power conductors from excessive induced potentials due to lightning disturbances. The induced potentials, which may be much higher than the normal operating voltages, can be decreased about 40 per cent. with a single earth wire and about 65 per cent. with two earth wires. The reduction is equivalent to doubling, approximately, the insulating value of the line insulation, and benefits, not only the line itself, but also apparatus connected thereto. The electrical protection is little affected by the material and size of the overhead earth wire, but, for actual improvement in transmission reliability, the earth wire must have at least the same degree of permanence and operating safety as the power conductors; it is, in fact, preferable in many cases to adopt a higher factor of safety for the overhead earth wire than for the line conductors.

It is usual practice to give the earth wire the same sag as the conductors; in some cases, however, it is advisable to give it less than the conductors, *e.g.*, an earth wire running above the conductors in an exposed district where ice and sleet loading is prevalent should be designed so that its sag when ice loaded will not be greater than that of the conductors without ice loading. Steel earth wires erected over the conductors are a potential source of danger; their life, owing to the effects of rust, cannot be equal to that of the line conductors, and they will thus eventually be the first to fail, with disastrous consequencies to the line. This difficulty may be overcome by the use of " Copperweld," which consists of a tough steel core with a copper covering inseparably welded to it, so that it combines the properties of steel with the rust-resisting qualities of copper. The copper exterior furnishes high conductivity: at 50 cycles frequency its conductivity is about six times that of ordinary steel, while in the case of steep-wave-front impulses and for high-frequency currents where skin effect is important, " Copperweld " has a still greater advantage. Wires and strands may be jointed in the same manner as steel or copper, and standard galvanised fittings and clamps may be used. Manufactured by British Insulated Cables, Ltd., it may also be used with advantage for stay, catenary, and span wires.

The company makes very neat aerial cable unions for steel-cored aluminium conductors. These joints have been specially designed with due regard to simplicity in assembly under field conditions and without the necessity of using special tools. The design is an adaptation of the principle of cone wedges so constructed and applied as to proportion correctly the stresses in both the steel and the aluminium wires; thus giving in the completed joint above 100 per cent. electrical, and not less than 100 per cent. mechanical, efficiencies.

Macintosh Cable Co., Ltd.

Inconspicuousness is one of the many features of this Company's neat and inexpensive overhead distribution system. As it has been designed to reduce the capital cost of supplying electricity to small houses and housing schemes, the aim has been to keep it as simple as possible, with the fewest possible number of standard components. In achieving its aim the Company has also gained another object, in producing a system which is practically unnoticeable when installed. The system is adaptable to all styles of houses and the main cables and service wires are insulated with " Maconite," a substance which possesses good insulating properties and will remain unaffected by exposure to the weather. Fig. 23 illustrates the method of bringing in the cables by means of shackle insulators under the eaves of the houses.

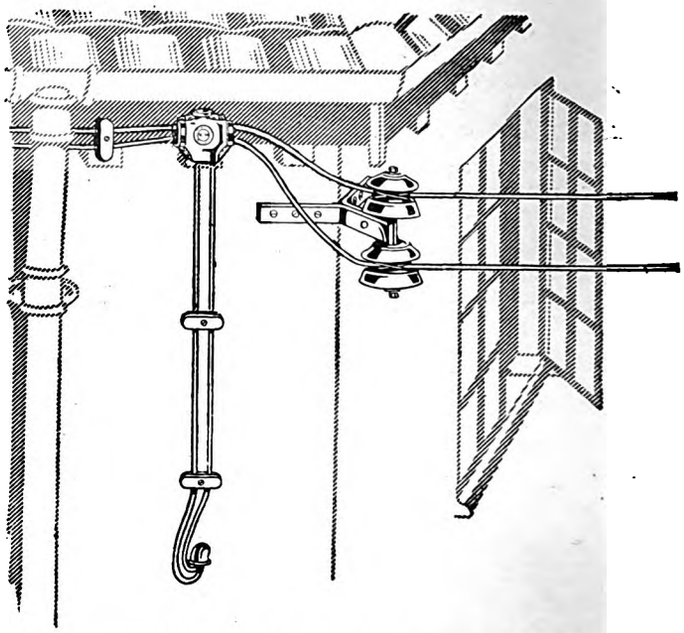


Fig. 23.—" Maconite " Eaves System of Wiring.

The point at which the overhead mains are fed from the underground feeder should be chosen so that, so far as is possible, balanced distribution may be obtained. The mains consist of single or twin " Maconite " insulated and braided cables, finished with an " indestructible " compound; according to the type of house, they are attached by neat porcelain cleats under the eaves, or to the walls and for wide spans, as from house to house, shackle insulators on angle brackets are used. By means of a small cast-iron tee box, connection is made to the individual consumer's cutout with " Maconite " cables, either single or twin, of a type similar to those used for the mains; they are led in through the wall by means of a porcelain leading-in tube, or, when the type of building permits, the wires may be led down in the cavity of the wall.

(To be continued.)

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Electric Fires for the Home.

Representative Examples from Manufacturers' Ranges.

In the ensuing pages we illustrate and give brief details of many patterns of electric fires. Although we have endeavoured to make a representative selection we are aware that any article of this nature cannot possibly take account of all the models which are available. We hope, however, that our notes will be of assistance to dealers in electric fires in the selection of their stocks and showroom models.

Messrs. Ferranti, Ltd., entered the electric fire field quite recently with a scientifically designed reflector fire, an example of which is illustrated. The improvements embodied in the latest form of Ferranti fire include the following:—The reflector is made by new methods, resulting in a more accurate parabola and a better finish to the chromium-plated surface; contacts of a new type mounted on arms of stout flat strip under the control of spiral springs of accurately-adjusted tension; improved switching arrangement and wiring by stiff copper connections under a strong sheet-steel cover, which is easily removable; and the terminal connections and earthing terminal are easy of access. The fire is equipped with one, two, or three bars of about 1,250 W. each. Fig. 1 illustrates a two-bar model with ornamentation.

Fig. 2 depicts one of the new fires which Metro-Vick Supplies has produced for the 1929-30 season. In a sheet-metal screen mounted on simple but substantial feet there is set a fire with a hammered reflector. There are two 2,000-W standard elements protected by a handsome grille. The fire can be obtained with an oxidised copper or oxidised silver finish. Another new Met-Vick fire is the imitation-coal model shown in fig. 12. This is the "Savoy" design employing the company's standard form of reflector. The imitation coal is arranged in a tray above the element reflector and the coal-fire effect is produced by means of a flame lamp at the back of the fire. Two sizes are available—2,000 and 3,000 W—and each of these can be obtained in oxidised copper or oxidised silver.

One of the latest fires made by Messrs. Veritys, Ltd., is the two-bar screen fire depicted in fig. 3. This has a hammered copper front and Jacobean enrichments. It is designed to conceal the average fire-

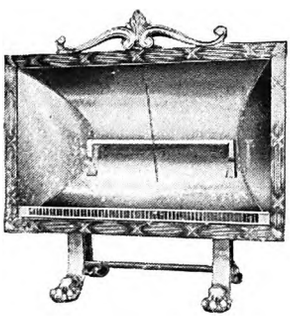

Fig. 1.—A Two-bar Ferranti Fire.

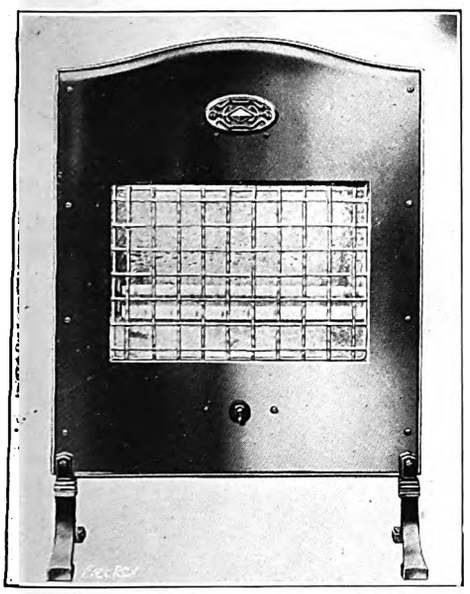

Fig. 2.—A Met-Vick Screen Fire.

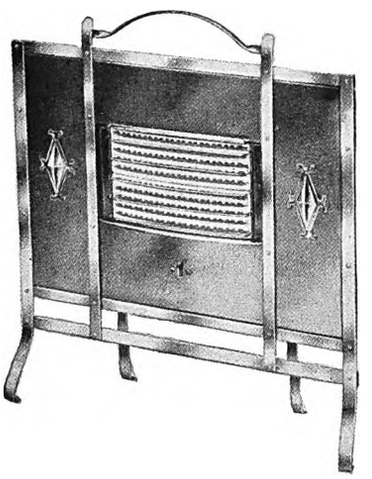

Fig. 3.—A Verity Screen Fire.

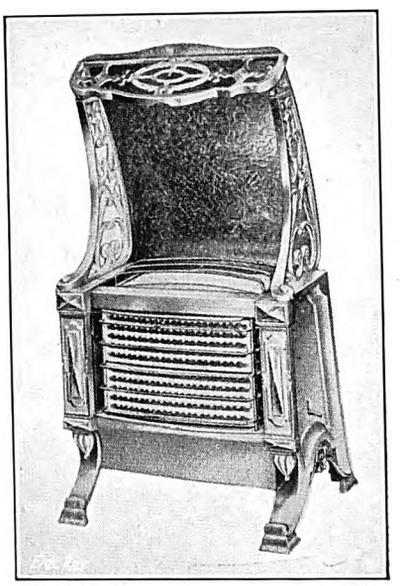

Fig. 4.—An Aluminium Model.

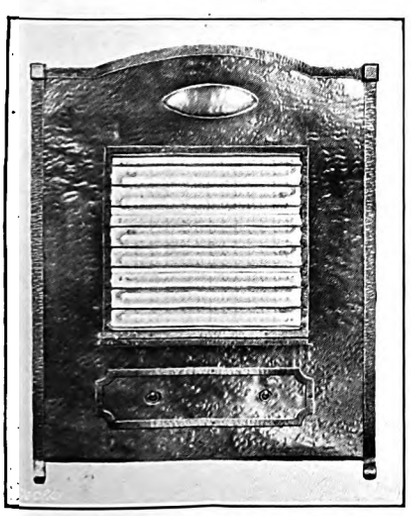

Fig. 5.—A "Magnet" Sheet-metal Fire.

Fig. 6.—A New "Magnet" Reflector Model.

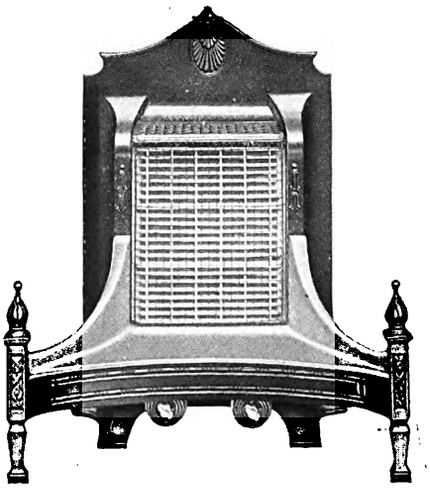

Fig. 7.—A "Quead" Curb Fire.

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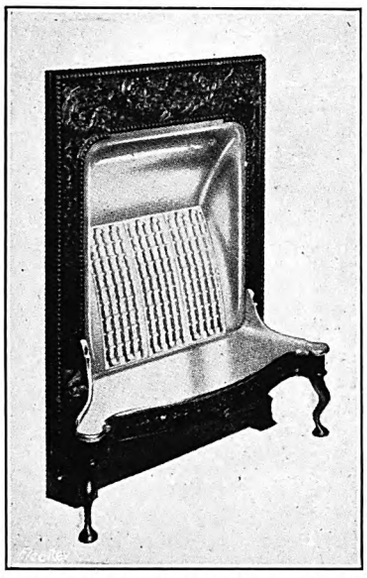

Fig. 8.—"The Westminster" Fire.

Fig. 9.—
A General Utility Design.

Fig. 10.—The "Beaufort" Fire.

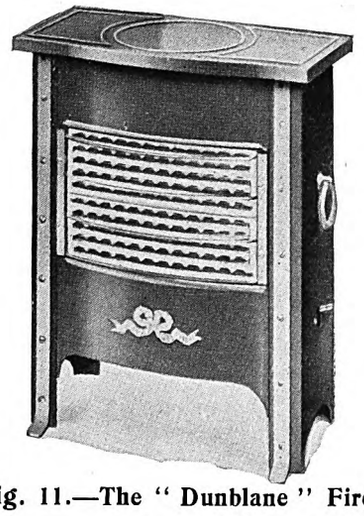

Fig. 11.—The "Dunblane" Fire.

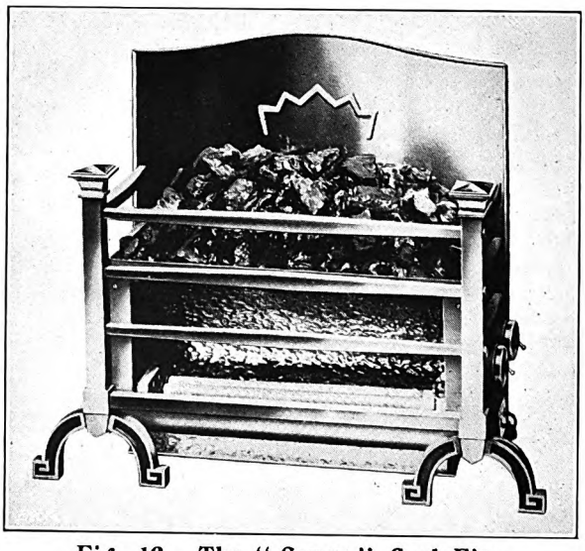

Fig. 12.—The "Savoy" Coal Fire.

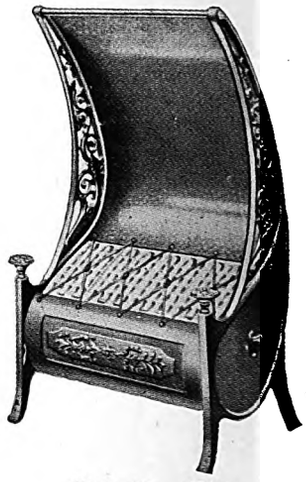

Fig. 13.—The
"Gloucester" Fire.

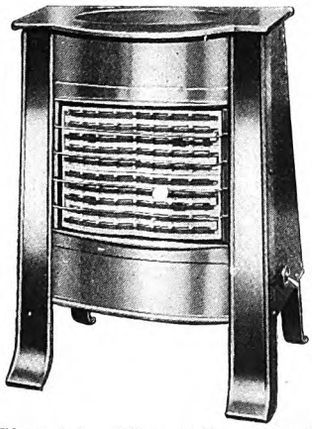

Fig. 14.—The "Berwick"
Model.

Fig. 15.—A "Shell" Design.

Fig. 16.—A "Countess" Fire.

Fig. 17.—A Belling "Radiant"
Fire.

Fig. 18.—A Belling
"Empire" Fire.

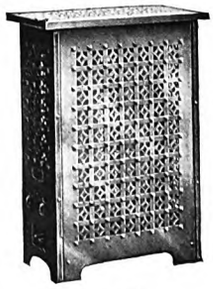

Fig. 19.—
An "A.E.G."
Convector.

Fig. 20.—The
"Riviera Major."

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Fig. 21.—The "Heetrod" Portable Fire.

Fig. 22.—A Ceiling Heater.

Fig. 23.—The "Sunset" Fire.

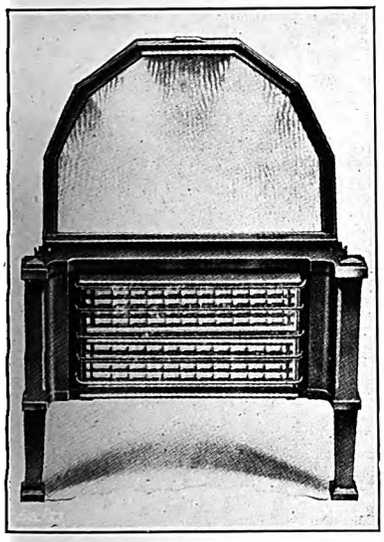

Fig. 24.—The "Rippleray" Fire.

Fig. 25.—A "Davidson" Reflector Fire.

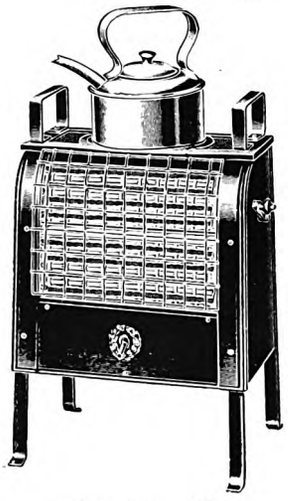

Fig. 26.—The "Cinderella."

Fig. 27.—The "Corona" Fire.

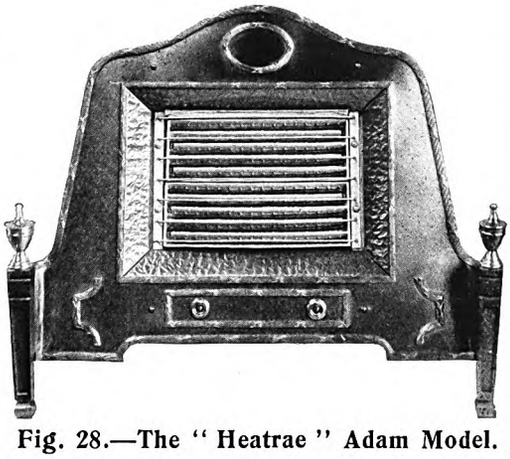

Fig. 28.—The "Heatrae" Adam Model.

Fig. 29.—A Jackson Tudor Fire.

Fig. 30.—An "Efescoal" Fire

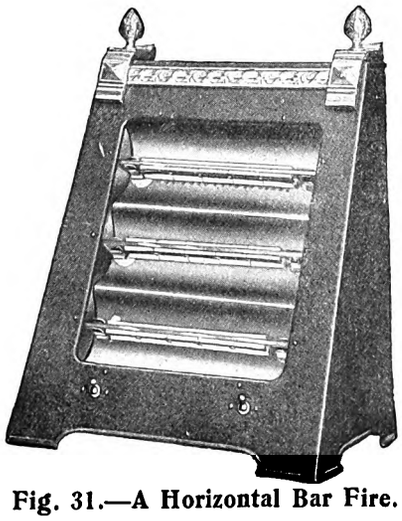

Fig. 31.—A Horizontal Bar Fire.

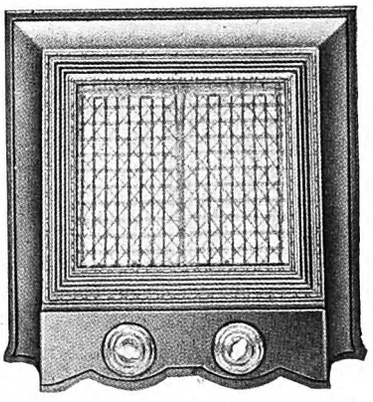

Fig. 32.—A "Highlow" Design.

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place, and is also portable, for use in any part of the room. The chief feature of the fire shown in fig. 4 (another Verity model) is that it is made of aluminium alloy, the reflector being of hammered copper.

Among the several new types of fires which have been added to the "Magnet" range by the General Electric Co., Ltd., is a handsome sheet metal fire in antique brass (fig. 5)—alternatively an oxidised silver finish can be supplied. It is designed for standing in a fireplace to completely hide an existing coal fire grate, and with this object in view the back of the fire is of smaller dimensions than the front to facilitate recessing into the grate opening. The loading is 3,000 W, and the control switch allows for three degrees of heat. Another "Magnet" fire is the portable model shown in fig. 6. It is soundly constructed and has a finish in real bronze colour with a reflector of hammered copper. It would appear to be particularly suitable for a boudoir or small bedroom. It is loaded to 1,250 W.

In our issue of September 20th (p. 481) we described a new fire-bar which is being made by Messrs William Geipel, Ltd. We now illustrate a fire in which this is employed. Fig. 7 shows a substantial cast-iron fire with a heavy nickel-plated curb. This model can be supplied with the body finished in satin black or ebonite black and a loading of 3,000 W or 3,750 W.

A fire of very handsome appearance is the "Westminster" model produced by Domestic Electrification, Ltd., and illustrated in fig. 8. The three 1,000-W bars are set at an angle in a shaped recess and two controlling switches are fitted. The fire is definitely designed for installation in a fireplace, and its substantial nature can be gauged from the fact that it weighs 50 lb. Five finishes are available, three in japan—art black, art silver and art bronze, and two in metal—electro-oxidised copper and oxidised satin brass. Another of the company's fires is the general utility pattern depicted in fig. 9 ("F.2"). This is fitted with two horizontal 1,000-W bars, separately switched. A larger model having three bars is also supplied. This type of fire is given any one of five japan finishes.

Several new and improved designs have been placed on the market by Electric Heating & Hardware, Ltd. The one depicted in fig. 10 (the "Beaufort") is probably unique, consisting as it does of an imitation coal fire surmounted by a reflector fire. Two 1,250-W elements are fitted, each being separately controlled by a kick switch. The "coal" is in one piece and can be removed easily. The standard finish is silver nickel, but other finishes are available.

Fig. 13 shows a fire of attractive design made by Carron Company. It is one of the company's "Cathedral" range, known as the "Gloucester," and is equipped with a handsome curved copper reflector. The elements are tilted towards the front and consist of four separately-switched 500-W bars. The fire is given one of four finishes—antique brass, oxidised copper or silver, and armour bright. Another fire in the same series is the "Dunblane" (fig. 11). This is constructed on simpler lines and has a flat top into which, if desired, an efficient boiling plate can be fitted. There are two separately-controlled 1,000-W fire bars. The fire has an eggshell black enamel finish with a vitreous-enamelled top and polished copper or nickel plated fittings.

The "Berwick" fire (fig. 14) is a new product of Premier Electric Heaters, Ltd. This is an efficient but inexpensive fire finished in antique copper or crystalline black with "double radius" elements giving a wide distribution. Two sizes are obtainable—2,000 and 3,000 W. Another "Premier" fire is shown in fig. 16. It is one of the range of six "Countess" fires, three of 1,500 W and three of 2,250 W. The company's curved elements are employed and are mounted at a slight angle to the horizontal at the foot of a polished copper reflector. Each size is obtainable in three finishes—antique copper, oxidised silver, and antique brass.

A fire of somewhat novel appearance is the "Shell" design illustrated in fig. 15. The shell-shaped back is of highly polished copper and at its foot there are fitted two 1,000-W elements each controlled by an "M.K." switch. Above the bars is a copper guard which enables the fire to be employed for boiling water, etc. The body of the fire is finished in oxidised silver. This fire is made by the Electric Heating Co.

Fig. 33.—The "Genie" Fire.

Fig. 34.—The "Warwick" Fire.

Fig. 35.—A "Cosyglo" Fire.

Messrs. Belling & Co. have produced several new models for this season. The "Empire" series, one of which is shown in fig. 18, has been designed to meet the growing demand for an efficient heater at a low price. The framework is of cast-iron with neat ornamentation. The fires are supplied with one, two or three 1,000-W, or with two, three or four 600-W "Multi-Parabola" bars. The mounting of the elements in the radiant fire (fig. 17) is unconventional. There are three of them (400 or 600 W) and they lie from back to front in chromium-plated wells. Brass and copper, and oxidised silver and copper finishes are available.

The convector heater shown in fig. 19 is produced by the A.E.G. Electric Co., Ltd. It is made in two sizes—950 W and 2,000 W, two switches being fitted in each case. Heat is radiated in all directions and the convector is suitable for medium and large-sized offices. A blue gunmetal finish is applied.

One of the fires which has been introduced this season by Electrical Utilities, Ltd., is the "Riviera Major" (fig. 20). This is a development of the "Riviera" fire—in fact it is really two of these fires mounted one above the other. The frame is a vitreous enamelled casting in which two "Infra-Ray" elements

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are fitted. The "Riviera Major" is obtainable in 2,000-W and 3,000-W sizes. A fire of entirely different design is the "Heetrod" portable fire shown in fig. 21. This derives its name from the type of element which is fitted—a nickel-chrome spiral wound on a grooved cylinder, which is clipped into spring contacts. The "Heetrod" fire has a 1,000-W loading, the side castings are finished in oxidised copper or polished nickel and the reflector is of polished and lacquered copper.

"Inventum" fires are among those which employ the parabolic trough reflector and they are very efficient. Our readers are familiar with the general range of "Inventum" fires; the one which we have selected from the latest list is novel. The ceiling heater illustrated in fig. 22 has been designed to give a pleasant radiant heat over a fixed area, or for small rooms where a floor heater would be in the way. The heater has a diameter of 17 in. and there are three 500-W elements; it is finished in chromium-plate. Mr. Alan Wright deals with "Inventum" appliances.

The "Newberry Magicoal" fire which was introduced by Berry's Electric (1928), Ltd., a season or two ago, has now been improved by the addition of "dogs" which add considerably to the ornamental value of the

Fig. 36.—Another "Cosyglo" Model.

Fig. 37.—The "Kenilworth" Fire.

fire. Among the new designs which Messrs. Berry's are putting on the market is the "Sunset" model (fig. 23). The loading is 3,000 W and the fire is finished in bright rustless steel and oxidised brass. An improved flame effect is incorporated in this pattern.

Messrs. Best & Lloyd, Ltd., obtain the "live" heat effect in their "Rippleray" fire in a novel manner. The light from a metal-filament lamp is passed through bubbling water and the image of the filament projected on to a glass screen shows as a system of flame-like lines. The effect is heightened by the moulded ripples on the glass screen and by the reflection from the facets of the sheet metal forming the back of the fire. One of the new "Rippleray" fires is illustrated in fig. 24.

Fig. 25 depicts a fire of very handsome appearance made by Messrs. Chesterton, Jones & Co., Ltd. This is the "Davidson" Model D.125, a highly-finished reflector type of distinctive design. The elements (2,000 W) are fitted horizontally at the foot of a polished hammered copper reflector. Antique copper, antique brass, and oxidised silver finishes are available.

A feature which we believe is embodied only in fires made by Messrs. H. W. Sullivan, Ltd., is employed in one of that company's new designs—the "Cinderella," which is illustrated in fig. 26. This takes the form of a movable element, which, by the operation of a handle at the side of the fire, can be raised and turned into a horizontal position for heating water, &c. The "Cinderella" is made in three sizes—1,000, 2,000, and 3,000 W. Five finishes are available, *viz.*, black enamel, black enamel with nickel-plated trivet, and antique brass, copper or silver.

A serviceable fire of the reflector type is the "Heatrae Corona" (fig. 27), made by Electric Fires, Ltd. This has a strong framework, of steel, brass, or copper as required, suitably ornamented and relieved. The easily-replaced firebars (2,000 W) are fitted at the foot of a repoussé copper reflector. The fire is 20 in. in height and width. Another "Heatrae" design is an "Adam" model, shown in fig. 28. It is made in two sizes—2,000 and 3,000 W. The fire is 2 ft. in width and is provided with a gilt or oxidised silver finish.

The Jackson Electric Stove Co., Ltd., has introduced a new colour scheme which adds to the decorative value of several models. This is a "Chinese fabric" finish in four colours—blue, bronze, grey and red. One of the fires to which this finish can be applied is illustrated in fig. 29. This is a three-bar Tudor design, each bar being loaded to 750 W. The standard finishes are antique brass, oxidised copper and oxidised silver.

Fig. 30 illustrates a typical example of the "Efescoal" fires supplied by Messrs. Falk, Stadelmann and Co., Ltd. It is of handsome appearance and has an old-brass or oxidised-silver finish. The two fire-bars each have a loading of 1,125 W and are separately switched.

The "Meracol" electric fires made by the Thermo-Path Co., Ltd., are of particularly handsome design; one of the latest patterns is that illustrated in fig. 31. This is a cheaper model of an existing pattern. It is of sheet-steel construction with three 700-W horizontal elements mounted in reflecting troughs. It is finished in black enamel with nickel or bronze ornaments.

The "Highlow" range of electric fires (Messrs. Archibald Low & Sons, Ltd.) is distinguished by its simple but dignified appearance. The example illustrated in fig. 32 is a 3,000-W model measuring about 19 in. square. It has simple ornamentation and is finished in black, bronze, armour bright or porcelain enamel (eight colours).

Among the fires which appear in the new season's catalogue of the Credenda Conduits Co., Ltd., is the "Genie" design shown in fig. 33. This is of the reflector type, the elements being arranged just below the centre of the reflector, so that the heat is reflected from above and below. Over the elements, which have a loading of 2,000 W, is a grid upon which small utensils can be placed. The fire is given an oxidised copper finish, and a convenient hand grip is provided.

The Revo Electric Co., Ltd., has introduced several attractive fires of the reflector type. Whilst the "Emitter" firebar, introduced four years ago, is still retained for all non-reflector patterns, a new firebar has been evolved to meet the particular need of reflector fires. The "Radiabar" element, as it is named, takes the form of steatite refractories threaded on to a square section monel metal core. The resistor is laid in a deep groove, which protects it from mechanical damage, and is operated at a comparatively low temperature. One of the new fires—the "Kenilworth" (fig. 37) incorporates both "Radiabar" and "Emitter" elements, the former being placed in the trough of the reflector, which provides a fire of very cheerful appearance. The "Warwick" fire (fig. 34), has two trough reflectors containing "Radiabar" elements. The curvature of the front gives a wide distribution of heat.

Fig. 35 shows one of the "Cosyglo" fires sold by Siemens Electric Lamps & Supplies, Ltd. It is a handsome Tudor design with an armour-bright finish, the "coal" being contained in a basket. Beneath the latter is a curved polished copper reflector. The loading is 2,000 W. The fireplace model shown in fig. 36 is another "Cosyglo" fire. One element is contained in the canopy and one in each of the vertical reflectors. The fire can be supplied in any finish and has a loading of 3,000 or 4,500 W as required.

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Electric Cookers.

A review of recent developments in the design and construction of domestic electric cooking equipment.

THE progress that has been made during the past year in the production of electric cooking equipment has been almost wholly commercial, as is evidenced by reports of increased sales from both supply undertakings and manufacturers. That happy position confirms our repeated assertion that the present design of electric cooking apparatus is such as to justify fully the efforts of supply engineers and managers in developing the cooking load.

The improvements that have been made in the design and construction of electric cooking apparatus in recent months have been mostly details of refinement, apart from the general tendency for specific purposes to introduce the smaller or "Junior" type of cooker. The enclosed type of boiling plate is becoming more generally adopted now, as the result of the experience of supply undertakings as regards reduced maintenance charges, and the principle of including an electric kettle as an essential part of each cooker is becoming universally accepted. The following notes on selected items from manufacturers' productions will, we hope, prove interesting and of value to all concerned in both the production and use of such appliances.

The A model of the "Tweenie" cooker, fig. 1, introduced by Electric Fires, Ltd., is a good example of the smaller type of cooker which is being provided generally for the small house or flat. It was once common practice to refer to the smaller types of cooker as being specially made for the small family, but there is a strong tendency in some directions for them to be used by families of, say, five to eight persons. In the smaller houses it often happens that the feeding of several workpeople has to be catered for at various times of the day, so that cooking operations are going on over fairly long periods, thus rendering the smaller type of apparatus more desirable. The "Heatrae" appliance to which we refer has a loading of 2.5 kW. It measures

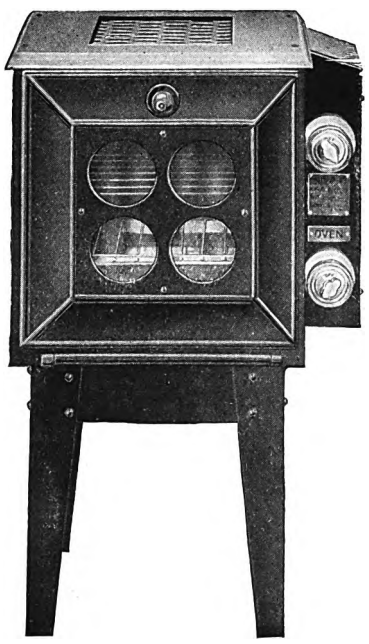

Fig. 1.—"Tweenie A" Cooker.

Fig. 2.—The "Xcel Minor."

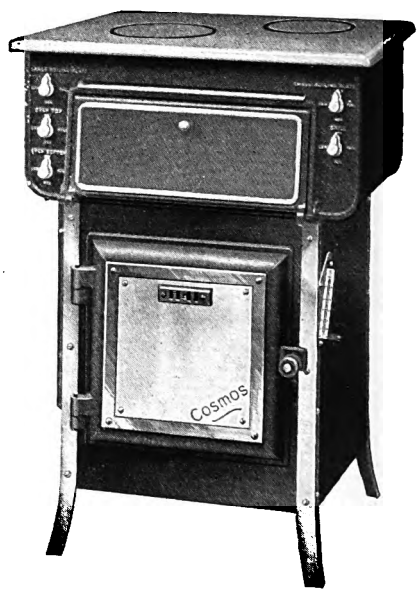

Fig. 3.—The Standard "Cosmos."

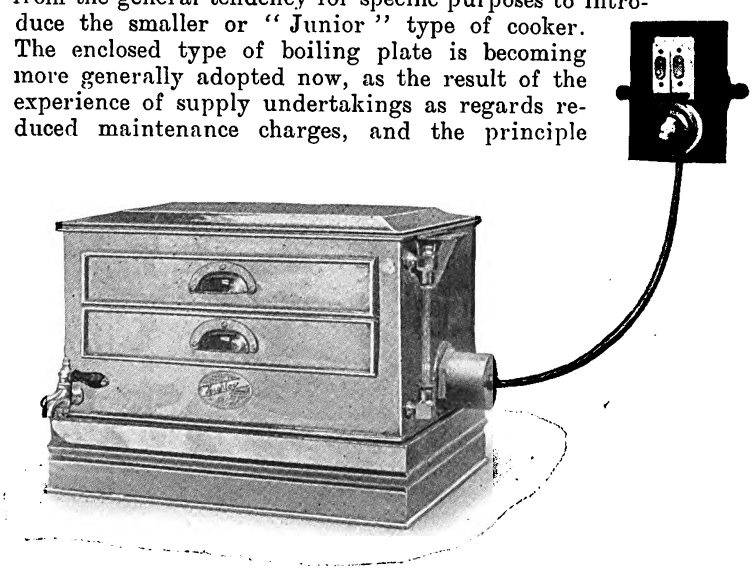

Fig. 4.—Pie Heater; Archibald Low.

Fig. 5.—"Masta" Cooker.

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2 ft. 5 in. high, 16 in. wide, and 12 in. deep. The oven dimensions are 10 in. high, 11 in. wide, and 11 in. deep. The equipment weighs 40 lb. Three-heat control is provided for all operations. The oven can be used without the stand, and is fitted with four small feet when used as a table cooker.

The " Xcel Minor " cooker, fig. 2, a recent product of Siemens Electric Lamps & Supplies, Ltd., adequately meets, it is claimed, the needs of those whose cooking requirements are limited to from two to four persons, and where space is a consideration. The front frame and switch plate are cast in one piece. Its appearance is neat and pleasing, the hob being vitreous enamelled, the oven door front white porcelain enamelled, and the remainder stoved black. For a small extra charge, it can be supplied all mottled enamelled. The grill-boiling plate is of new construction, and not only boils efficiently, but heats the oven or grills at the same time. The spirals are entirely protected by fireclay tubes. When boiling only is required, a deflector plate is inserted in the oven to throw the heat upwards. In addition to the special grill-boiling plate, which also serves as the top oven element, a bottom element is provided, also entirely protected, and this is fitted with a polished aluminium reflector to throw the heat upwards. The switches are both reciprocating, 3-heat control, with only the knobs projecting. The oven is lagged throughout (including the door) and the bottom is ribbed to ensure maximum heat dispersion. The oven cooking space is 12 in. by 11 in. by 12 in., and the overall dimensions are 16 in. by 14 in. by 19 in. The total loading is 2,500 W: bottom oven element, 1,000 W, and boiling plate and grill, 1,500 W. The cooker is supplied complete with a grill tin, with grid; an oven shelf; a grid shelf; a deflector plate; and an instruction card.

With regard to the larger types of domestic cookers, the standard model, fig. 3, produced by Metro-Vick Supplies, is an interesting example of modern practice. The cooker is very easy to operate, so assuring positive results for the housewife. Very little air circulates through the oven. The top plate can be supplied nickel plated or enamelled; the interior and door linings are also enamelled, and there is a white-enamelled plate on the door. The overall, oven and hotcupboard dimensions are, respectively, 37 in. by 27 in. by 18 in., 14 in. by 14 in. by 12 in., and 17 in. by 12 in. by 6 in. There are two boiling plates, 8⅛ in. and 6¼ in., with loadings of 2,000 and 1,200 W, respectively, and the oven may be loaded at 2,000 or 2,500 W. An extra 1,200-W boiling plate can be obtained, if desired. The grill is loaded up to 1,500-W, and is supplied with either tubular or open-coil elements.

Fig. 4 shows an electric pie heater which has been introduced by Messrs. Archibald Low & Sons, Ltd. It has a capacity for 24 pies, and the maximum loading is 1 kW. The overall dimensions are 19 in. by 12 in. by 10 in. high. The heater is constructed of planished copper, nickel plated, having two drawers, each capable of holding twelve pies. The top is hinged towards the back, and it covers a recessed dish for peas, sauce, &c. The oven is heavily tinned throughout on the inside. A gauge glass, filler and draw-off tap supplying hot water are fitted on the water jacket. The element is of the makers' new porcelain-type immersion heater, which admits of the element being withdrawn without unscrewing the immerser from the heater, and is arranged for three-heat control by a switch which, with d.p. fuses, is mounted on a separate switchboard.

Another small type cooker of interest is the " Masta " cooker, fig. 5, of Messrs. H. W. Sullivan, Ltd. This consists of an oven fitted with two 500-W " Uniglow " elements, and a boiler-grill equipped with a 1,500-W " bridge " type element. A drip pan, grid, and a connector plate are provided. The overall dimensions are 16 in. high, 22 in. wide, and 10 in. deep, and the oven measurements, respectively, are 7½ in. by 12 in. by 8½ in. The weight is 35 lb.

Several new models of " Magnet " cookers are being put on the market this season by the General Electric Co., Ltd., and there is now, it is claimed, a model available to suit every home and to satisfy all tastes. These cookers are an example of the combination of sound utility and attractive appearance. As regards the electrical equipment, each " Magnet " cooker is arranged with a view to the utmost economy in maintenance costs. The elements are easily accessible and replaceable, and totally-enclosed quick-boiling plates and reciprocating three-heat switches for controlling the circuits are fitted. Wherever possible, the wiring of each cooker is concentrated at its side, an arrangement which serves the double purpose of rendering every circuit quickly accessible, and of providing under the hob a warming cupboard of liberal dimensions. Replaceable units, such as hotplates, &c., are connected to thumbscrew terminals, a practice which, for long life and service in proximity to heating elements, experience has proved to be satis-

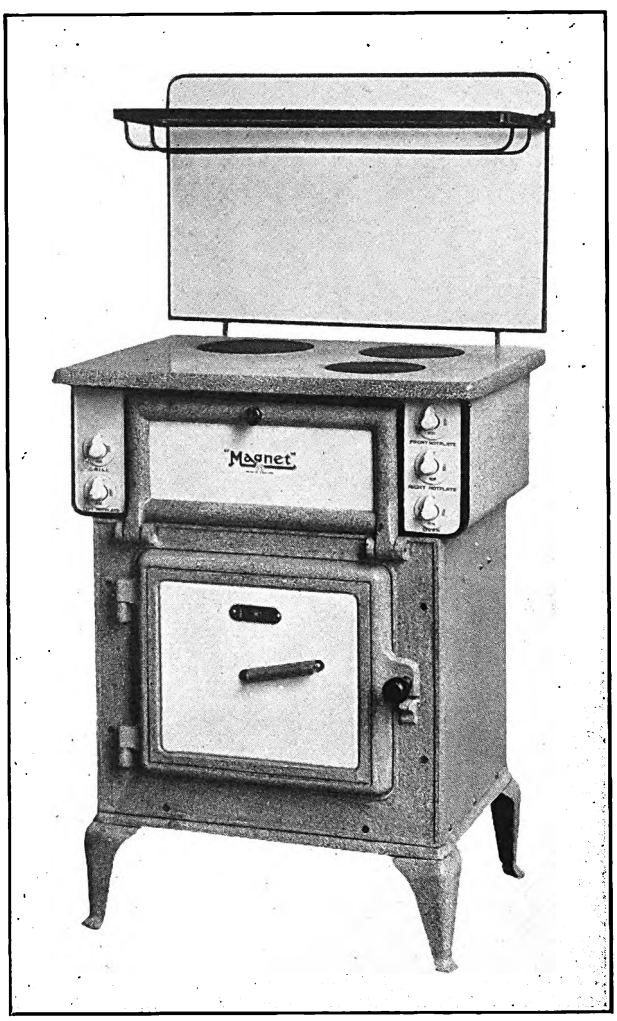

Fig. 6.—A " Magnet " Range; 8-9 Persons.

factory. Efficient earthing facilities are provided close to the main terminal, and care is taken to ensure good continuity throughout the entire frame of each cooker. Corners are everywhere rounded to facilitate cleaning, and in most " Magnet " cookers the oven interiors are completely withdrawable. Great care is evidently taken to ensure a tight-fitting door, and each oven is adequately lagged with heat-insulating material on all six faces. Totally-enclosed hotplates are fitted as standard on all models. Two of the new " Magnet " models may be mentioned particularly. One of these is designed to fulfil requirements for a family of up to eight or nine persons, and the other for a family of up to four or five persons. The former, fig. 6, is supplied with side or side and bottom heating, and has three hot plates of 8 in., 7 in., and 6½ in. dia., respectively; a drip tray is fitted below each hotplate. The grill is fitted in a large hot cupboard situated between the oven and hob, the cupboard having a drop-down door. The standard finish is black enamel with the hob enamelled mottled grey. The other model, although a comparatively small one, is nevertheless complete in equipment. It incor-

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porates an oven, grill and two totally-enclosed hot plates, all arranged for three-heat and separate control. The grill is fitted below the hob and the oven has a drop door.

The "Angelus" family cooker, fig. 8, which is marketed by Messrs. Charles Joyner & Co., is an interesting cooker from both the engineering and domestic points of view. It is made in two models. No. J202 cooker is constructed of stoved black enamel castings, and has a vitreous enamelled oven interior and bottom plate. The splash plate and door panel are of white vitreous enamel. The other model has a mottled vitreous enamelled top plate, front and other castings, as well as the other features mentioned in the case of the J202 cooker. Each model is fitted with a grill pan and grid, oven racks, a dividing tray, splash plate, and a plate rack. A pilot lamp and a plug and socket are also fitted to each cooker. The overall, oven and hot-cupboard dimensions are, respectively, 26 in. by 22 in. by 55 in., 16½ in. by 18 in. by 15 in., and 16½ in. by 18 in. by 6 in. The oven loading is 2,000 W, the grill loading 1,500 W, and the two boiling plates are loaded at 1,600 and 800 W, respectively.

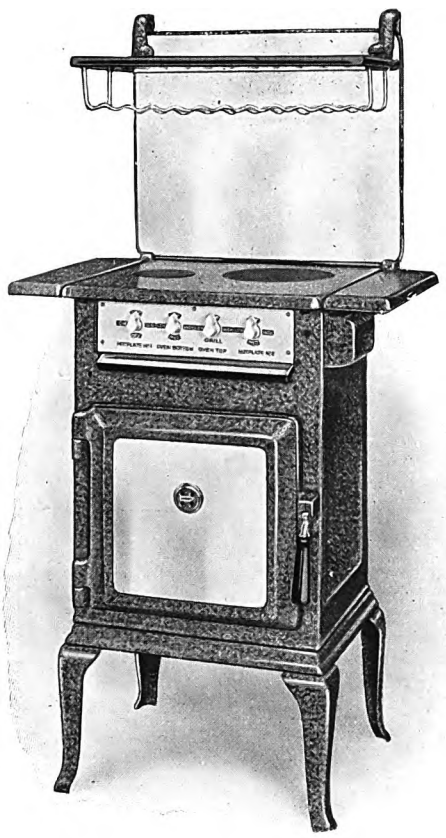

Fig. 7.—The No. 514 Dolphin.

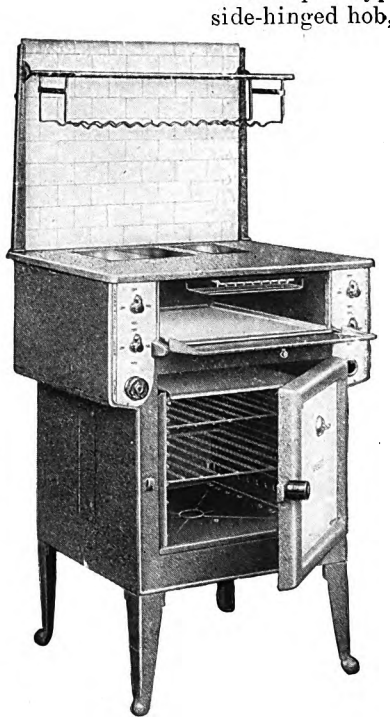

Fig. 8.—"Angelus" Family Range.

Many unique features are claimed to be incorporated in the design of the M2 cooker, fig. 9, of Carron Company, the chief essentials being: vitreous enamel finish, inside and out; all interior fittings and parts also enamelled by this process, to withstand the ravages of corrosion, moisture, and continual use over many years; side and bottom heating; detachable oven interior; extra large warming chamber; bus-bar wiring; cast-iron fuse box; cam-lever door handle; carefully bedded and fitted joint between oven door and body; "Sadia" fast boiling plates fitted as standard; fuses of the "Triumph" type are housed under enamelled plate; and side-hinged hob, allowing access to all connections, even when the cooker is situated in a confined space. The dimensions are: overall, 37½ by 28¾ by 19 in.; oven, 16½ by 15½ by 14½ in.; hot closet, 5 by 19⅞ by 15½ in.; large boiling plate, 8¾ in. dia.; and small boiling plate, 7 in. dia. The loadings are: oven, 2,400 watts; grill, 1,500 watts; large boiling plate, 2,000 W; small boiling plate, 1,200 W; and total, 7,100 W.

Among the larger table cookers, the No. E9562A "Universal" model, fig. 10, marketed by Messrs. L. G. Hawkins and Co., Ltd., is of particular interest. This is furnished with two open-type and two enclosed nickel-trimmed interchangeable hot plates, mounted on a white porcelain sanitary cooking top. Each plate is controlled by a 3-heat indicating snap switch, and is separately and accessibly fused. The finish is in full porcelain enamel, with a white porcelain back, splasher, oven door panel, receptacle and outside oven panel, switchboard cover, shelf, warming closet door sides and top, grey porcelain enamel legs, oven door frame, corner castings and shelf bracket. The heat is efficiently conserved by extra heavy insulation 1¾ in. thick. The cooker includes an adjustable damper, an extra deep aluminium broiler pan, nickel-plated broiler racks, a special oven rack, a pilot light, oven-temperature indicator, one broiling and one baking unit, a special slide tray to catch liquids spilled through open units, concealed by the fuse panel.

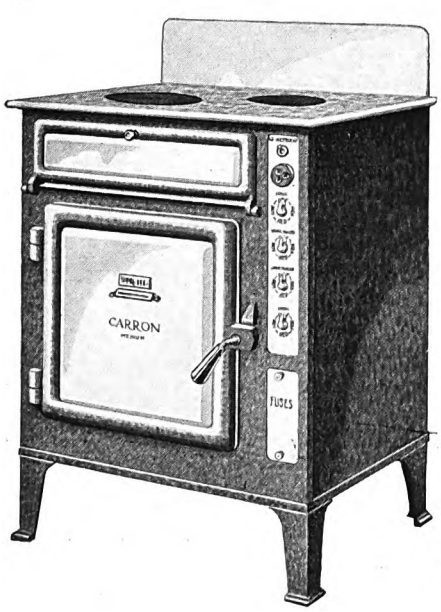

Fig. 9.—"Carron" M.2 Model.

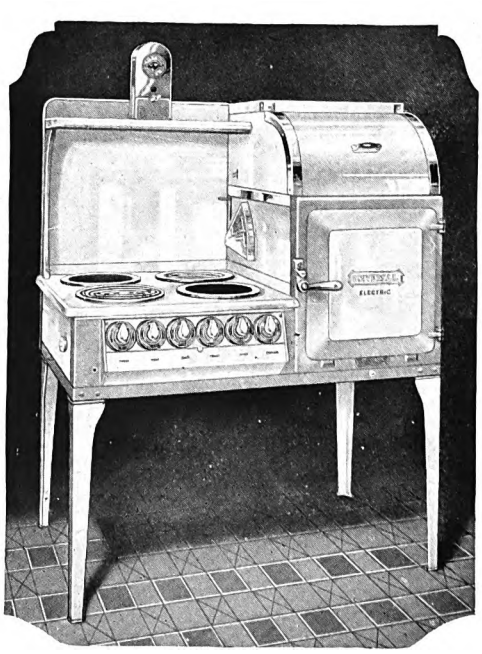

Fig. 10.—"Universal" Table Cooker.

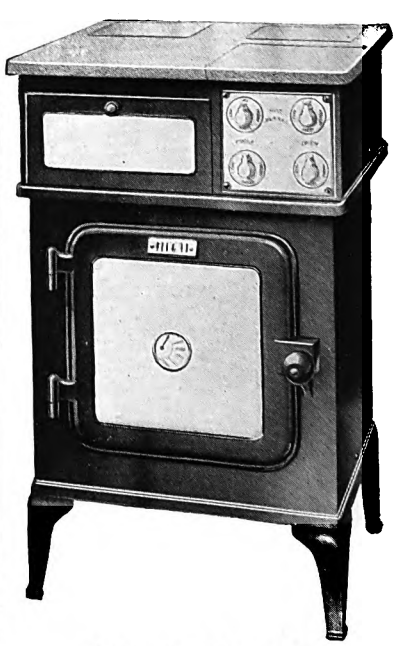

Fig. 11.—No. 1280 "Hotpoint-Falco" Model.

(*Continued on p. 663.*)

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Each unit is quickly and easily controlled by a 3-heat reversible indicating snap switch separately and accessibly fused. The oven is monel metal lined, and there is a flue connection in the back of the oven. The warming closet is fitted with a 550-watt heating unit. A standard attachment plug receptacle is conveniently located on the side of the range for small appliances. The floor space occupied by this cooker is 24 in. by 41½ in. The overall dimensions are 43 in. wide by 54 in. high by 27½ in. deep. The height from the floor to the cooking top is 33 in. The crated weight of the cooker is 398 lb. The total loading is 9,050 W, the loadings of the parts being: Open plates, 1,500 and 1,000 W; enclosed plates, 1,500 and 1,000 W; baking unit, 2,000 W; broiling unit, 1,500 W; warming closet 550 W.

The "Dolphin" No. 514 cooker, fig. 7, of Domestic Electrification, Ltd., has been designed to meet the requirements of a family of four to five persons. It comprises a roomy oven, a grill, and one large and one small boiling plates. The whole of the frame-work of the cooker is constructed of fine-grade cast-iron, and all steel parts are vitreous enamelled. The dimensions and loadings are as follows:—

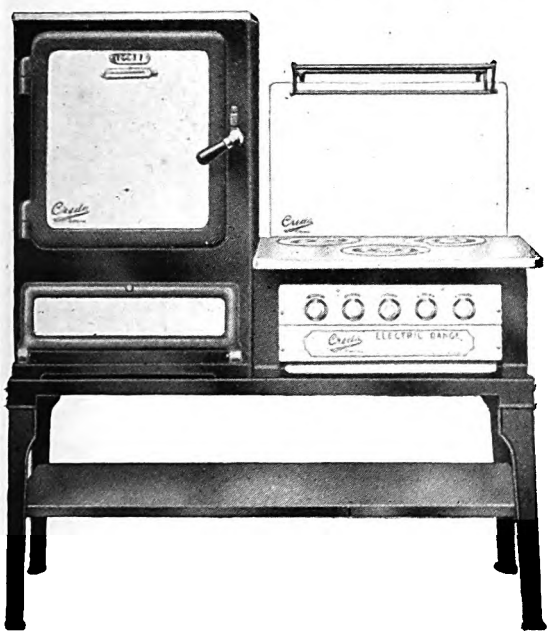

Fig. 12.—A "Creda" Table Range.

Overall Dimensions. H. W. D.	Cooking Space. Oven.	Loading in Watts. OVEN.		8" Boiling Plate.	4½" Boiling Plate.	Grill
		Bottom.	Top.			
35"×19"×16½"	14"×12"×12"	High 750	1,075	1,600		
		Med. 375	700	800	550	700
		Low 187	244	400		

The oven lining is constructed of specially selected sheet steel, with rounded corners throughout, the top, sides and bottom of which project into the door opening of the cast-iron frame. It is porcelain enamelled inside and outside, providing exceptionally easy cleaning facilities. The heating elements are placed at the top and bottom of the oven, and are controlled by two separate three-heat switches. The elements are fitted with special plug-in contacts, in order to facilitate their instantaneous removal for cleaning or inspection purposes. The hob is constructed of cast-iron and has a mottled finish of specially hard vitreous enamel. It contains one 8-in. and one 4½-in. high-efficiency, quick-operating, enclosed-type boiling plates, carefully spaced to ensure the highest efficiency under working conditions.

A wide range of "Hotpoint-Falco" cookers has been recently introduced by the Hotpoint Electric Appliance Co., Ltd., specially designed for hiring schemes. The prevention of moisture passing from the boiling section to the oven section is attained by the provision of a cast-iron crown plate with a protecting rim. This also provides a non-corroding division plate that will not be readily destroyed under the extremely adverse conditions in which some cookers operate. The oven element assembly is in one unit and can be removed from the oven by undoing two wing nuts and three terminal wires

Similarly, the whole switch assembly is made in one complete unit, and can be readily removed after detaching the right-hand portion of the hob and disconnecting the leads from the boiling plates, grill and oven. The wiring of the cookers is simple, but efficient. Where a relatively long run of conductor is necessary, as under the hob to the boiling plate or plates on the extreme left, the wiring is carried in a channel of cast-iron, vitreous enamelled. This coating of enamel is made to withstand a voltage of 1,500 r.m.s. to "earth," and this insulation is additional to the protection afforded by the insulating coverings on the conductors. The domestic cookers are so designed that they can readily be converted into simple-type table cookers with the additional requirement only of a new top casting for the oven unit, or, if it is preferred, either portion can be used separately. The "Hotpoint-Falco" range covers sizes for from 2-4 persons up to 25-30 persons. Fig. 11 shows model No. 1,280, which is designed for from 6 to 8 persons. The boiling plates, grill and oven, are arranged for three-heat control. The two 8-in. square boiling plates are each loaded at 1,800 watts, the grill at 1,750 watts, and the oven at 2,400 watts. The hob dimensions are 26 in. wide by 22½ in. deep, the available oven cooking space being 16 in. by 16 in. by 14 in high.

Another large table-type cooker is depicted in fig. 12, a product of Credenda Conduits Co., Ltd. In this "Creda" model the oven is raised to a convenient working height, and the hot cupboard under the oven containing the grill is very useful for plate warming and keeping food hot. A splash plate is included a standard equipment. The standard finish is white vitreous enamelled oven door panel, hot cupboard panel and switchplate; granite grey vitreous enamelled hob and oven top; mottled grey vitreous enamelled removable oven interior; vitreous enamelled oven linings; other parts triple stoved black. The overall dimensions are: height, 59 in.; width, 54 in.; depth, 22 in.; hob to floor, 35 in. The oven cooking space is 18 in. by 16 in. by 16 in. The three boiling plates, 8¾ in., 8¾ in. and 7 in., are 2 kW, 1.5 kW, and 1.2 kW, respectively. The grill is loaded at 1.75 kW and the oven at 3.4 kW.

The "Revo Manor" cooker is another interesting table-type apparatus. The porcelain enamelled shelf between the legs is very useful in the kitchen. The overall dimensions are 48 in. wide, 19½ in. deep, and 47 in. high. The oven cooking space is 15 in. by 13 in. by 13 in. The two boiling plates are 8 in. in diameter,

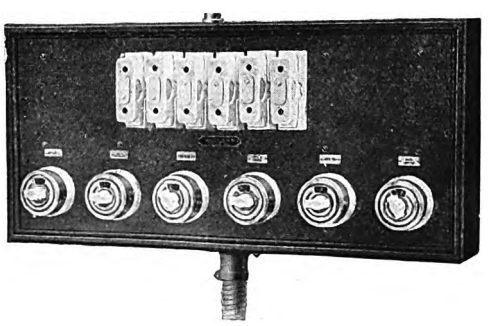

Fig. 13.—A "Jackson" Control Board.

and the grill measures 10 in. by 7 in. The loadings are 1,800 W oven, 1,500 W grill, and 1,600 W boiling plates.

It is, of course, important that all cooking apparatus should be installed complete with efficient control apparatus, and some interesting examples of cooker control boards are being supplied as part of the apparatus by some of the cooker manufacturers. All the cooking apparatus supplied by the Jackson Electric Stove Co., Ltd., is complete with suitable electrical control, and unless otherwise specified plain-type switch panels are fitted to all domestic cookers. All switches are of the rotary indicating pattern, and of ample capacity to operate the circuits they control. The fuses are of the replaceable and non-arcing type. All connections are made at the back, and suitable bus-bars are fitted. Fig. 13 shows the "Jackson" control board for domestic cookers.

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Electric Water Heaters.

Selections from the New and Improved Apparatus now upon the Market.

We pointed out in our Special Domestic Issue last year that the one domestic electric service which still " lagged " was that of water heating, and that the difficulty was not due to the design of the apparatus or lack of enterprise on the part of the manufacturers, but to the old supply problem of tariffs. While considerable progress has been made by some undertakings during recent months, generally our remarks of last year are still appropriate. We hope that the following notes on selections from the apparatus available will afford some encouragement to those engineers who are in the stages of uncertainty.

The General Electric Co., Ltd., has devoted a good deal of research and experiment to problems involved in domestic water heating, and the " Magnet " storage heaters which it has just introduced to the market can be said to incorporate all the features shown to be necessary for high thermal efficiency combined with robustness of construction. The company's latest type is made

Fig. 1.—Two-gallon " Magnet " Water Heater.

in sizes from two gallons upwards, and arranged for floor or shelf mounting. Of pleasing appearance, with white enamel finish, it is of sound mechanical design, very reliable, and capable of operation within suitable limits of temperature. It is double cased and has 3 in. of efficient lagging between the outer case and inner container, conducive to low heat losses and economy in current consumption. The inner container is of steel or copper, and is tested to withstand a pressure of 25 lb. per sq. in. The heater, which is suitable for all pressures (both a.c. and d.c.) from 200 V upwards, is equipped with a thermostat of the quick-make and-break bi-metal type, which can carry up to 5 A alternating current. For direct current and more than 5 A alternating current a relay must be added. The standard " Magnet " withdrawable-type immersion heater is fitted. The two-gallon heater, fig. 1, has a loading of 50 W; the 30-gallon model is loaded to 2,000 W.

Electric Fires, Ltd., claims to have a " Heatrae " tank to suit almost every purpose. Fig. 2 shows a " Heatrae " circular tank mounted on a stand. This type is preferable in certain cases where it is not convenient to fix the heater on the wall. The usual height of the stand to the bottom of the tank is 2 ft. 6 in. The " Heatrae " circular tanks are supplied in capacities from 2 to 30 gal., and with loadings from 750 to 2,000 W. Thermostatic control is provided for.

The following are the principal features introduced in the new models (1929) of the Bastian Meter Co., Ltd.: thermostatic control in types 800 and 900; highly efficient cork lagging; towels and linen can be aired on the lid; immersed heating elements; wall brackets and outlet in base in types " W "; ball valve arranged for either side of heater; nickel-plated fittings; minimum furring, due to low-temperature heating design; and easy maintenance. The heating tube on which the sediment settles can be easily unscrewed and cleaned. The loose lid is easily removed for inspection purposes. Fig. 5 shows the W 802 model. This has a capacity of 11 gal. and is loaded normally at 500 W. Extra loading up

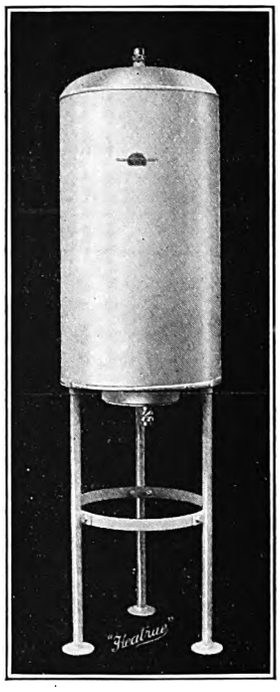

Fig. 2.—" Heatrae " Tank on Stand.

Fig. 3.—11-gal. " Angelus " Equipment.

to 1 kW may be provided at extra cost. The control is by adjustable mercury-break thermostats.

The " Angelus " water heaters introduced by Messrs. Charles Joyner & Co. are finished in white enamel, unless otherwise ordered. The elements are of the well-known " Angelus " high-efficiency type, contained in copper sheaths. The thermostat is of a high-grade mercury type. Unless otherwise specified, the thermostats are set to 190 deg. F. With a loading of 750 W the output in hot water at 190 deg. F. is 11 gal. every 5½ hours, which is equivalent to two baths of 15 gal. at 100 deg. F., or one bath of 28 gal. A larger and quicker output of hot water can be obtained if required by specifying a higher loading than the standard 750 W. The " Angelus " water heaters represent good-quality British materials and workmanship. The tank is heavily lagged with low thermal conducting material. The patent " Angelus " heater units are fitted with special alloy supports which prevent corrosion. The mercury-type thermostat is suitable for a.c. or d.c. Fig. 3 shows an 11-gal. " Angelus " tank for use over a bath, basin or sink. It is loaded at 750 W and has a mercury thermostat.

A speciality of the Arora Co. is a range of immersion heaters, indicating the offer of service for hot-water supply, either from existing hot-water cylinders or by new boilers designed for the exact requirements of hot-

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water service in any household. The Arora Co. is of opinion that every household should be consulted as to its hot-water requirements prior to installing such

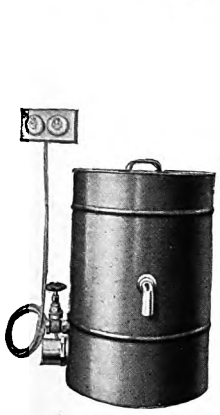

Fig. 4.—A " Met-Vick " Heater.

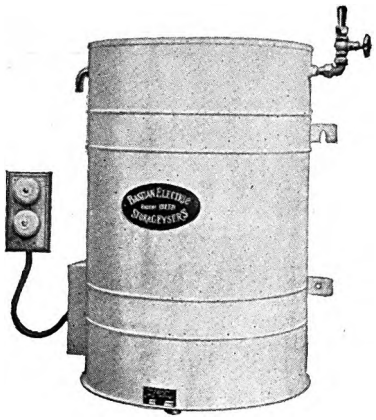

Fig. 5.—" Bastian " W 802 Water Heater.

boilers. For instance, take the average case of a small family; it recommends in that case a 10- to 12-gal. boiler, well heat insulated, loaded with 2 kW towards

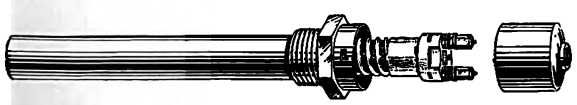

Fig. 6.—" Arora " Immersion Heater.

the top, that is to say, within 2½-gal. capacity of the top of the cylinder, and loaded with a further 2 kW at the bottom of the cylinder. Each 2-kW loading is operated separately through a 3-heat switch, and in addition a thermostat may be arranged to give automatic cut-off at a predetermined temperature, say, 190 deg. F. Such a boiler is fed from the low-pressure system of water supply off an existing ball-tap fed tank, and the hot-water supply is given through the usual hot-water taps. Provided the run of hot-water piping is not too long there is generally no need to lag such pipes. The boiler will serve a threefold duty. (1) Immediate supplies of hot-water for washing up; the top heat is switched on to full when within 10 to 15 minutes the necessary supply is forthcoming. (2) Continuous hot-water supply; for this the bottom loading of 2 kW is switched on to the low, and the arrangement in mind will give about 440 W; this will usually meet the general call for ordinary hot-water in the house, and will materially reduce the times for the rapid service referred to in No. 1 and No. 3. (3) If all cold, then both loadings of 2 kW are switched on to give a hot bath in ¾ hour.

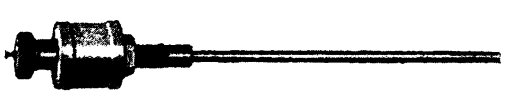

Fig. 7.—" Genii-Maclaren " B.N. Control.

It is suggested that such a convenient arrangement is far superior to the 500-W loadings, or even less, so frequently recommended to give continuous hot-water supply, because obviously with a 24-hour run, and the emptying of the hot-water cylinder by use of a couple of hot baths, with such systems there is no facility for rapidly getting hot-water again. Fig. 6 shows an " Arora " immersion heater. It consists of a nickel-plated copper tube into which is inserted the robust element. The standard sizes vary from 6¾ in. to 22½ in. long, with loadings from 330 to 1,500 W.

Fig. 4 shows an example of the range of electric storage water-heaters introduced by Metro-Vick Supplies. These " Met-Vick " appliances are designed for 100/110, 200/210, 220/230 and 240/250-V circuits, for constant loadings or with booster elements. They are constructed of heavy-gauge copper, white enamelled outside and tinned inside. Hot water is obtained merely by turning the cold inlet valve handle, cold water displacing the hot without intermixing. The internal container is tinned and the external jacket polished and lacquered. The intervening space between the jackets is packed with heat-insulating material and hermetically sealed. The heating element consists of a low-wattage section for constant running, and a booster for intermittent use. A domed and lagged lid is fitted, which may be removed for cleaning purposes. The heaters with constant loading are supplied with capacities from 6 gal. up to 20 gal., and loadings from 250 to 1,000 W. " Constant " and " booster " heaters are supplied in similar capacities and for constant loadings of from 100 W to 500 W, and booster loadings from 1,000 W to 2,000 W.

A ball-valve type of heater introduced by Credenda Conduits Co., Ltd., is shown in fig. 9. It has a capacity of 17 gal. and is loaded at 1,000 W. The interior is tinned copper. The overall dimensions are 3 ft. 6 in. high by 1 ft. 8 in. in diameter. This type of heater contains its own cold-water cistern controlled by a ball-valve tap. The bottom pipe shown is the outlet which is connected to the bath or basin taps. A thermostat cuts off current when the tank is full of water at approximately 190 deg. F. This heater can be connected to a main cold-water supply direct, and complies, it is claimed, with all water companies' regulations.

Messrs. George Nobbs, Ltd., have a number of " Genii-Maclaren " patent electric temperature control sets for special purposes and close temperature working. The type " B N." control set, fig. 7, for temperatures up to 562 deg. F. (300 deg. C.), ±½ deg. F. sensitiveness, is suitable for tanks, rooms, refrigerators, ovens, incubators, oil pipes, sterilisers, hot plates, presses, distillation processes, testing plant, baths, &c.

The type " F N " control set, fig. 8, for high temperatures up to 1,830 deg. F. (1,000 deg. C.), is designed for furnaces, crucibles, &c. The purpose of these electric control sets is to automatically—by a mechanical action—make and break the electrical circuit of the power or heating unit used in the rooms, tanks, apparatus, &c., and so keep them at a constant heat. The control is operated by the direct expansion of a sleeve immersed in the material to be treated, or within the chamber in which a steady temperature is desired. The functioning of the control and switch or relay is as follows:—When the temperature surrounding the sleeve rises or falls,

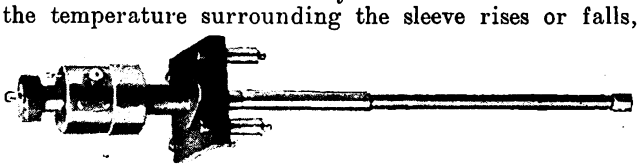

Fig. 8.—" Genii-Maclaren " F.N. Control.

the electrodes close or open the switch or relay, which operates on the main circuit. Thus, by making and

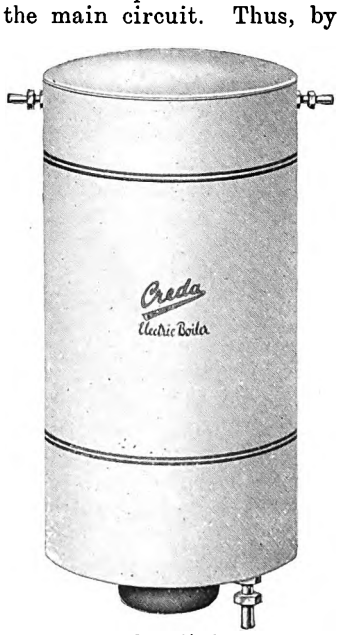

Fig. 9.—Ball-valve " Creda " Heater.

breaking the electrical supply, the pre-determined temperature is maintained with the minimum consumption.

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Electric Lighting Fittings.

A Selection of Decorative and Serviceable Designs.

THE types and designs of lighting fittings are so multitudinous that it is almost impossible to present examples which will give a fair idea of the whole. We have, however, selected a few fittings made by some of the leading manufacturers to give an indication of the designs available. Probably the most notable development in the last year or two has been in the direction of panelled glass fittings, of which there are now very wide ranges. The totally-enclosed pendant seems to have supplanted the open bowl to a great extent. Pressed glass is being increasingly employed in electric lighting.

The "Duplex-a-Lite" fittings supplied by Messrs. L. G. Hawkins & Co., Ltd., are now well known. The

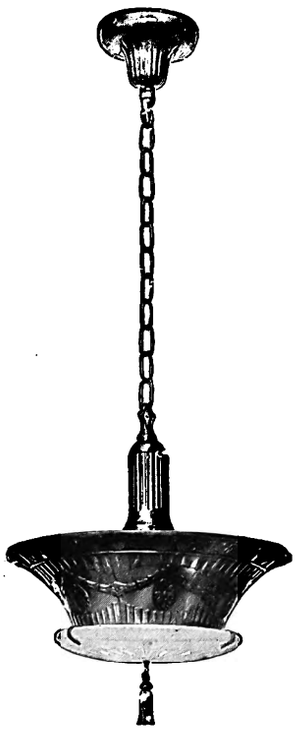

Fig. 1.—A "Duplex-a-Lite" Fitting.

Fig. 2.—A Bracket to Match.

Fig. 3.—An "Ivanhoe" Enclosed Unit.

device employed in these fittings is designed to direct 80 per cent. of the illumination upward to the ceiling, whence it is reflected in the form of gentle diffused light. The remainder passes directly through a lower fitting which also has a diffusing effect. A typical "Duplex-a-Lite" model is depicted in fig. 1. The colour scheme in this instance is silver and blue, gold and black, or gold and green. A special wall bracket is supplied to match the fitting; this is shown in fig. 2. The range includes a wide selection of designs and colours. An example of the plainer lighting glassware supplied by the company is illustrated in fig 3. This is one of the "Ivanhoe" range, which comprise several dustproof units of the pendant and ceiling types. It is 9 in. in diameter and suitable for a 60 or 75-W lamp.

The General Electric Co., Ltd., has recently added a wide range of new season's lighting fittings to the vast assembly of "Everything electrical" always on view in its showrooms at Magnet House, Kingsway, W.C.2.

These are of the most varied character, and range from small bathroom fittings to wonderful pendant creations exceeding 4 ft. in diameter. All are of the most modern design and incorporate a number of refinements not hitherto met with in the lighting world. They are the products of the new Magnet Works at Birmingham, and include an array of pleasingly designed metal work housing various types of moulded, etched, and tinted panel glassware. As panelled glassware fittings are now the vogue the company has specialised in the production of a wide range of these artistic forms of fittings. These include pendants, brackets, and standards that incorporate many pleasing features. They are designed for use with from three to as many as 120 small wattage "Pearl Osram" lamps which are now more generally preferred to the correspondingly smaller number of high powered lamps which were so popular a season or so ago. Fig. 5 illustrates a panelled pendant fitting of novel design, while fig. 4 shows the principle applied to a wall bracket. On the other hand, fig. 6 depicts one of the simpler pendant fittings of which the company has a large range.

Messrs. Philips Lamps, Ltd., have recently introduced a new range of enclosed ceiling fittings, forming a section of their "Phililite" series. Owing to their small overall height these fittings are suitable for low ceilings. The bowls are of three-ply glass having a very low absorption factor and they are supplied with a ceiling plate which facilitates their installation. There are seven models in the range, four designed for 60- or 100-W lamps, and three for 100- or 200-W lamps. One of the range is depicted in fig. 7.

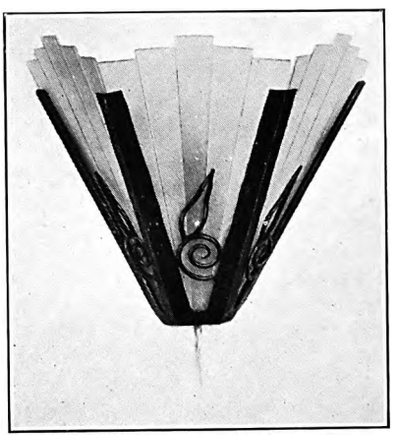

Fig. 4.—A Panelled Wall Bracket.

Fig. 14 depicts the "Sanaray" utility ceiling fitting which is produced by Siemens Electric Lamps and Supplies, Ltd. It is particularly

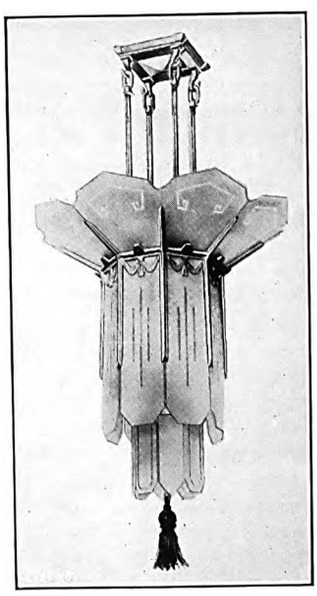

Fig. 5.—A G.E.C. Panelled Pendant Fitting.

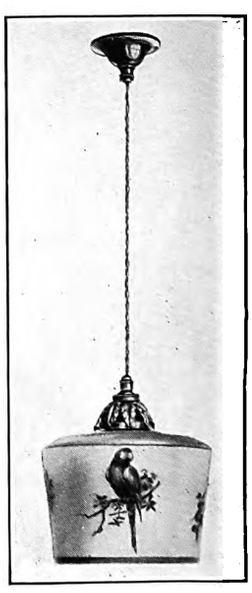

Fig. 6.—A Decorated G.E.C. Unit.

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suited for bathrooms, kitchens, &c. The glassware is 6 in. in length and diameter, and can accommodate a 60-W lamp. The canopy can be obtained in the usual metal finishes or white enamel. Another Siemens fitting is shown in fig. 9—the "Ultralite." A special feature of this is the glass canopy which improves the light distribution. The fitting is made in four sizes, ranging from 10 to 16 in. diameter. Fig. 8 illustrates

Fig. 7.—A "Phililite" Ceiling Fitting.

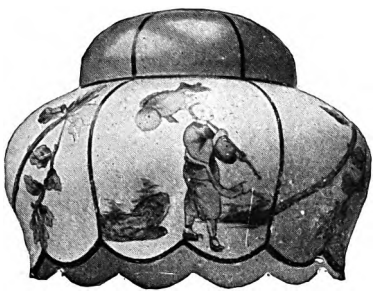

Fig. 8.—A Siemens Decorative Shade.

Fig. 9.—The "Ultralite" Fitting.

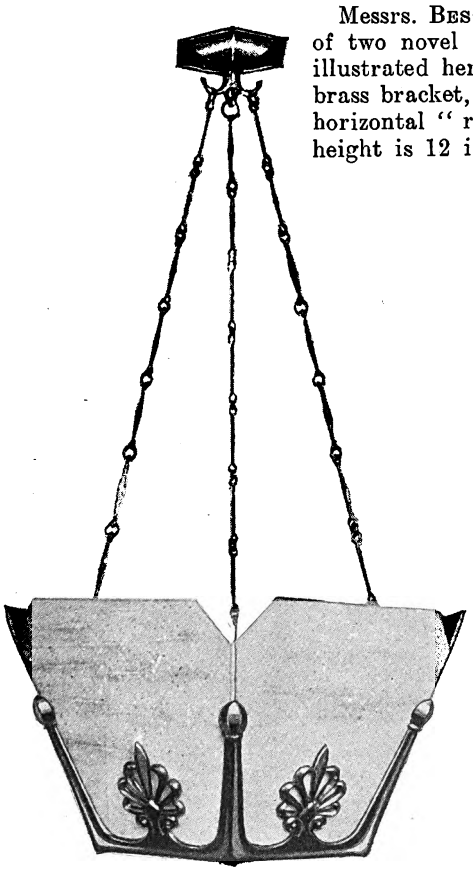

Fig. 10.—A Panelled Pendant.

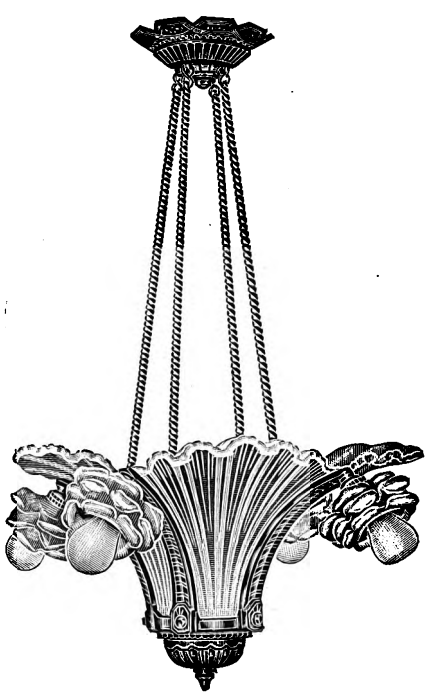

Fig. 11.—A Pressed-Glass Panel Fitting.

a typical decorative glass shade supplied by the same company. It bears a Chinese design in pale yellow and orange.

Messrs. Falk, Stadelmann & Co., Ltd., are keeping abreast of the demand for panel-type fittings. Two of those supplied by the company are illustrated, fig. 10 being a pendant and fig. 12 a wall-pattern fitting. The fittings are made of fine cast-brass and can be provided with a variety of types of glass, although Messrs. Falk, Stadelmann find that antique amber tinted glass is in the greatest demand. This style of fitting, although originally designed for public buildings, is becoming very popular domestically.

A somewhat large and novel fitting is that shown in fig. 11, which is supplied by the Wholesale Fittings Co., Ltd. It is a French pressed-glass panel fitting with a total length of 34 in. and a spread (distance between the outside lampholders) of 24 in. There are four lamps inside and four mounted round the outside. This is one of a range in which the fittings are solid cast metal finished in oxidised silver, the glassware generally having a satin matt surface, some being salmon tinted.

Originality is displayed by the shades recently put on the market by Messrs. F. Parks, Ltd. The principal materials employed in the production of these are "Vitreo-colloid" and "Moiré cellon." An excellent example of the former material is shown in fig. 13. This is particularly suitable for modern art furnishings. A dignified panelled shade in Moiré cellon appears on the floor standard illustrated in fig. 16. This is a beautiful fitting, the material having the appearance of watered silk.

Messrs. Best & Lloyd, Ltd., have sent us particulars of two novel and very modern table lamps which are illustrated herewith. Fig. 20 depicts a "U" shaped brass bracket, mounted in a metal base, which bears a horizontal "rimpled" glass panel shade. The overall height is 12 in. The second example (fig. 19) consists

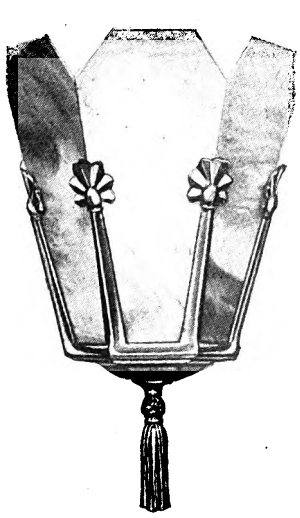

Fig. 12.—A Panelled Wall Bracket.

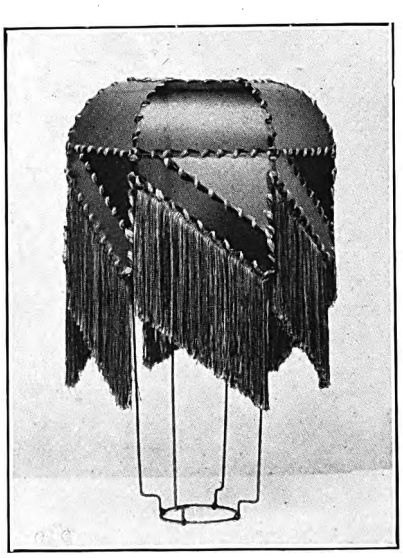

Fig. 13.—A "Vitreo-Colloid" Shade.

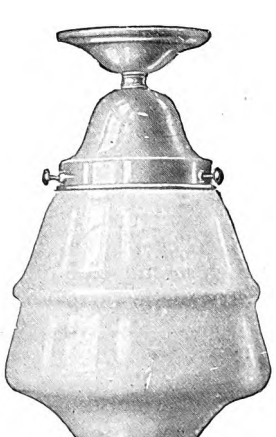

Fig. 14.—The "Sanaray" Fitting.

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of a brass tripod stand, with handsomely shaped feet, bearing a triangular hooded shade. The height is 21 in. to the apex of the star surmounting the whole. In these lamps the glass can be either plain-obscured or " Fire-light " tinted.

Messrs. S. G. Leach & Co., Ltd., have introduced a series of table standards and brackets in " Ebolite," a moulded bakelite composition which as its name suggests is similar to ebony in appearance. We illustrate a typical standard (fig. 21) and a bracket (fig. 17). The bracket is shown mounted in a special box which is supplied for sinking into a wall.

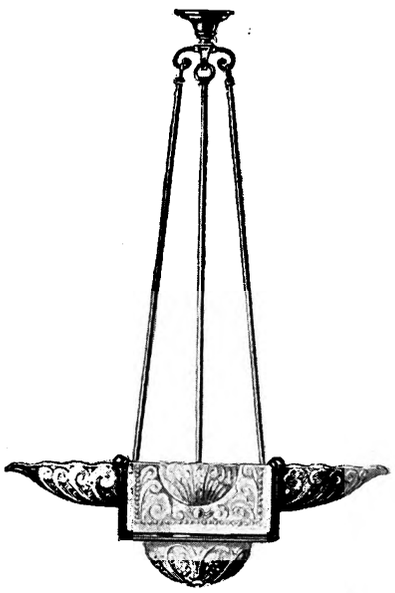

Fig. 15.—A " Moonmist " Pendant.

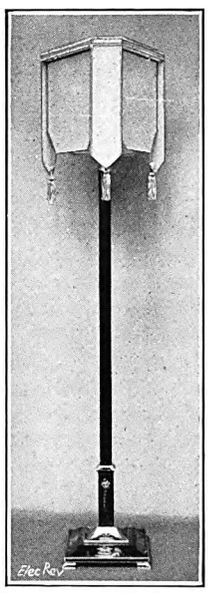

Fig. 16.—A " Moiré-Cellon " Shade.

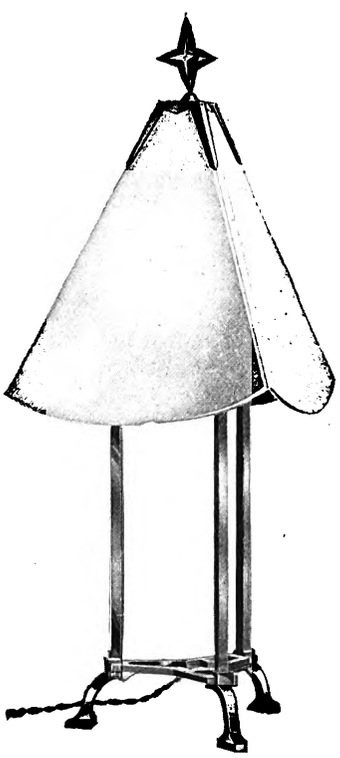

Fig. 19.—A Vertical Table Lamp.

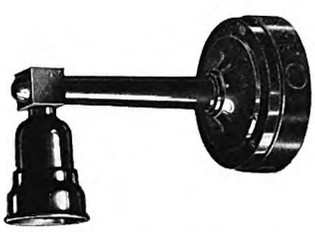

Fig. 17.—An " Ebolite " Bracket.

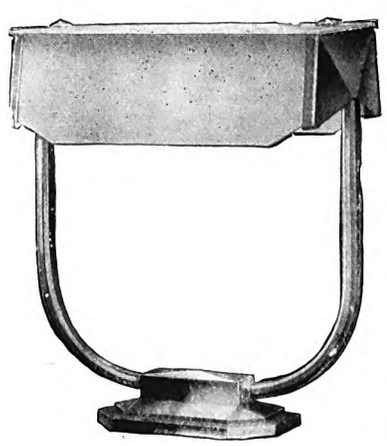

Fig. 20.—A Horizontal Table Lamp.

The little table lamp which is depicted in fig. 22 is a Korting & Mathiesen product. This can be employed in many positions and the shade is adjustable to any angle. The base is so designed that the lamp can be hung on a wall. The reflector can be brought down upon the reflecting and diffusing base so that only a small amount of light is allowed to escape, enabling the lamp to be used as a night light.

One of the specialities of Lighting Trades, Ltd., is " Moonmist " pressed glassware. Practically any shape or design can be produced in this material and the results are very good. Usually the glass is made in the form of panels which can be combined with metal-work to form all types of fittings. We illustrate two typical examples of " Moonmist " work, fig. 15 showing a pendant of unusual design and fig. 23 a wall-bracket of a very decorative nature.

Mr. Eric Marx has put on the market a collection of very modern " Erecta " lighting fittings built up from plain frosted or tinted glass panels. The colours available are amber shaded to yellow, yellow shaded to white, and pink shaded to white. We illustrated one of the fittings in fig. 18—a two-tier model suggestive of a lotus. It is equipped with a 100-W lamp and has a diameter of 18 in.

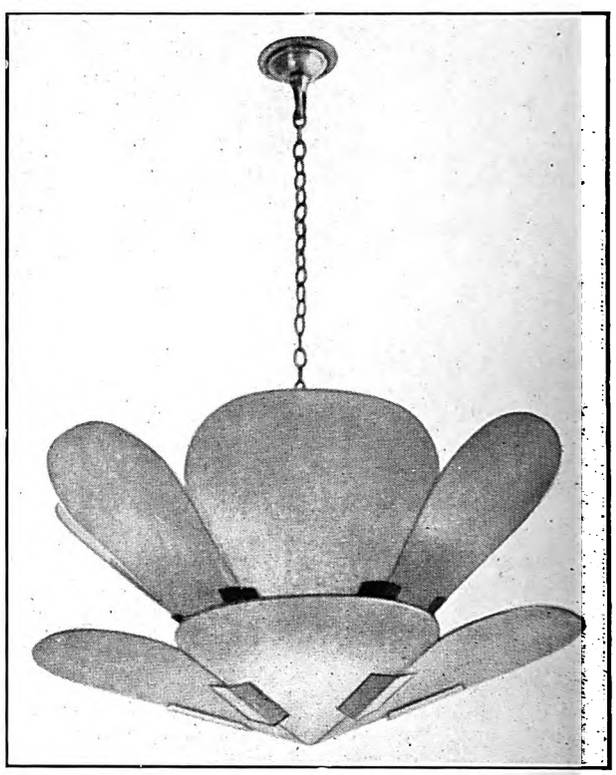

Fig. 18.—A Two-tier Panel Fitting.

Fig. 21.—An " Ebolite " Standard.

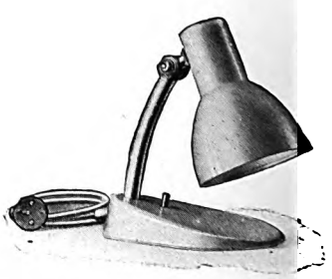

Fig. 22.—The " Kandem " Adjustable Lamp.

Fig. 23.—A " Moonmist " Wall Bracket.

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Other Electrical Appliances.

Some Smaller Applications of Electricity.

IN this section we have endeavoured to indicate how many smaller applications of electricity in the home are provided for. It includes a number of very useful appliances but it by no means exhausts the possibilities. Two or three boiling plates are described; we do not think that the advantages of this device are fully realised. Several useful accessories are described.

A very useful appliance for the home is the "Xcel" towel rail (Siemens Electric Lamps & Supplies, Ltd.) shown in fig. 1. This is constructed of nickel-plated brass tubing and the source of heat is a tubular enclosed element placed at a convenient height for circulating warm air currents through towels hung over the two top rails. It is about 3 ft. in height and width and has a loading of 175 W, which is ample for the purpose. Messrs. Siemens also supply the "Xcel" boiling plate illustrated in fig. 11. This is of substantial cast-iron construction and is identical with the hot-plate fitted to "Xcel" cookers. The diameter of the plate is 9 in., and it is 4½ in. high. It can be supplied with a single 1,500-W "heat," or equipped with a three-heat switch.

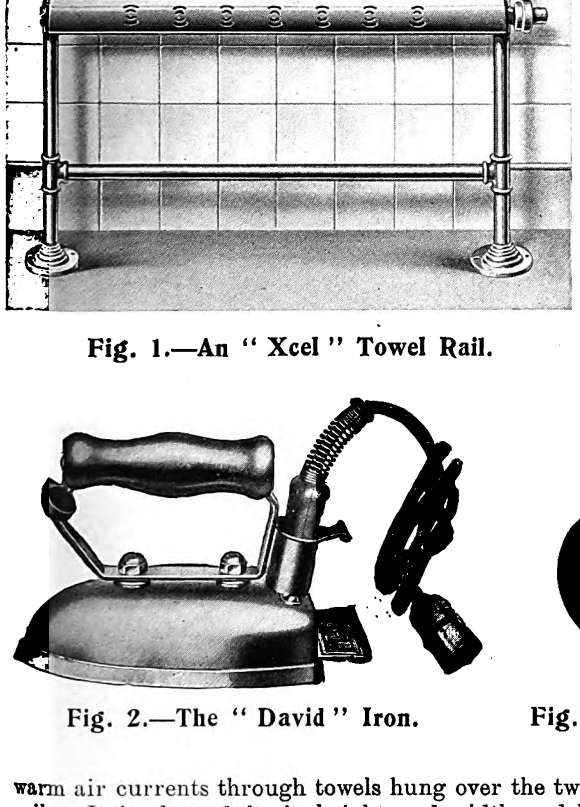

Fig. 1.—An "Xcel" Towel Rail.

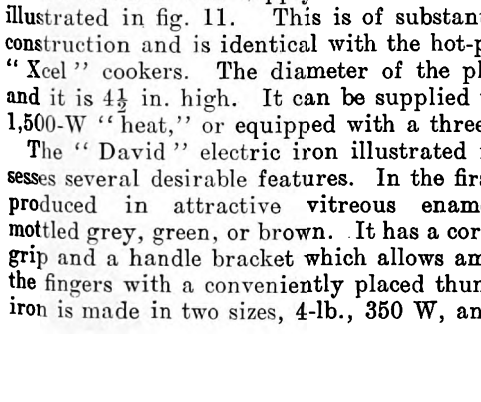

Fig. 2.—The "David" Iron.

The "David" electric iron illustrated in fig. 2 possesses several desirable features. In the first place, it is produced in attractive vitreous enamel colours—mottled grey, green, or brown. It has a correctly-shaped grip and a handle bracket which allows ample room for the fingers with a conveniently placed thumb-rest. The iron is made in two sizes, 4-lb., 350 W, and 5½-lb., 450 W. The makers are Messrs. Chesterton, Jones & Co., Ltd.

The "Heatrae" boiling ring shown in fig. 3 (made by Electric Fires, Ltd.) is capable of carrying out all kinds of minor cooking operations. It has a fairly large element (1,320 W), which is wired so that by means of a snap switch heats of 660 and 330 W can be obtained. The diameter of the ring is 8 in. and it is mounted on a frame which houses the switch and gives the appliance a total height of 5½ in. The ring can be obtained with an open top, as illustrated, or with a solid top.

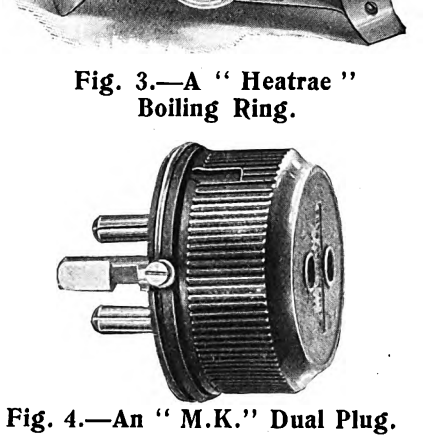

Fig. 3.—A "Heatrae" Boiling Ring.

The horizontal switch plug illustrated in fig. 5 was recently introduced by M.K. Electric, Ltd. It has been especially designed in keeping with the very narrow skirting boards which are found in many modern buildings. The example shown is for surface mounting. The switch plugs can also be obtained for flush mounting, two and three-pin non-interlocking, or three-pin interlocking. Fig. 4 shows the "M.K." safety plug which can be inserted into the company's standard socket; the addition of a plug permits the use of two appliances on the same point. The plugs embody 5-A fused sockets.

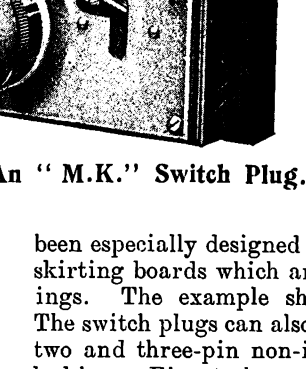

Fig. 4.—An "M.K." Dual Plug.

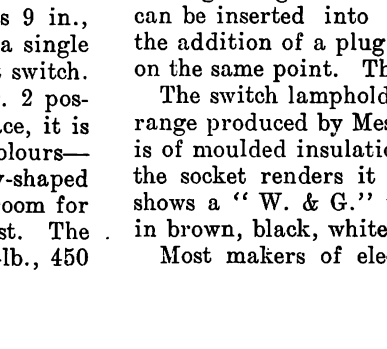

Fig. 5.—An "M.K." Switch Plug.

The switch lampholder shown in fig. 6 is one of a range produced by Messrs. Ward & Goldstone, Ltd. It is of moulded insulation and a reinforced brass liner in the socket renders it practically unbreakable. Fig. 7 shows a "W. & G." pendant switch which is supplied in brown, black, white, coral pink, blue and red.

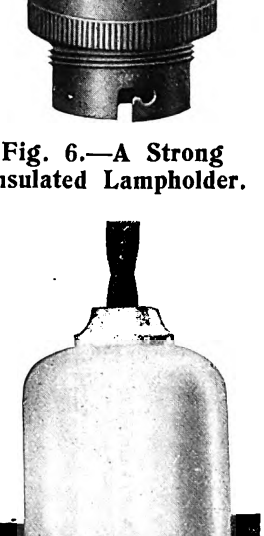

Fig. 6.—A Strong Insulated Lampholder.

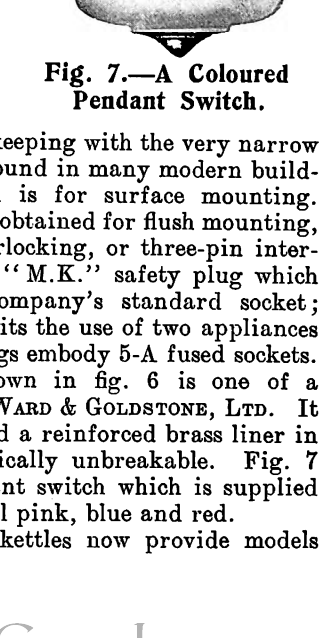

Fig. 7.—A Coloured Pendant Switch.

Most makers of electric kettles now provide models

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which guard against burning out. In the case of the Jackson Electric Stove Co., Ltd., a "Safety-Switch" kettle is made. In this a switch with a spring in tension is held in position by a pawl. When overheating occurs the solder holding a toothed wheel upon a shaft is melted and the switch is released. The switch can be reset by means of the press knob seen on the left of the kettle which is illustrated in fig. 8. The kettle is made in three sizes, 2, 3, and 4 pints, with appropriate loadings, and in polished or nickel-plated copper.

The "Smoothwell" electric irons produced by Premier Electric Heaters, Ltd., are of excellent design and finish. In addition to the ordinary type, the range includes one fitted with the "Birka" patent regulator, which maintains the iron at the right temperature. A "signal" type connector, as illustrated in fig. 9, can be provided with the irons. This embodies a warning lamp which remains burning all the time the iron is in circuit.

The "Aspiron" electric suction cleaner (fig. 10) handled by Metro-Vick Supplies is an internal dustbag machine of sound construction. It has a novel swivel head arrangement which enables every part of a room to be cleaned from a central position without moving the cleaner. A foot-operated switch is fitted and the appliance is provided with a set of tubes, brushes and nozzles.

A useful appliance made by the Electric Heating Co. is the coffee percolator depicted in fig. 12. This has a capacity of three pints and is made of stout nickel-plated metal. The handle is of a heat resisting material overlaid with interwoven black and white cane.

Messrs. L. G. Hawkins & Co., Ltd., supply the hot-plate shown in fig. 13. This is circular in shape with a 660-W coiled element fitted beneath an open grid. Underneath the element there is a nickel-plated reflector which adds considerably to the efficiency of the appliance. The diameter is 6 in. and the hot-plate has a conveniently shaped ebonised handle and fibre feet.

The tea kettle illustrated in fig. 14 is a handy appliance. In the base a 500-W element is fitted which is ample for the capacity of 2½ pints. A removable tea-sieve is employed in the kettle. The kettle has a nickel-plated or antique-brass finish, and is supplied by the A.E.G. Electric Co., Ltd.

The General Electric Co., Ltd., is now marketing an entirely new range of "Magnet" bakelite bell accessories which include bases and covers, buzzers, pushes and bell transformers. One of the most interesting items of this new range of accessories is a neat type of transformer to work off a.c. mains. Fig. 15 shows one of the new bells.

Messrs. Archibald Low & Sons, Ltd., produce the table warming plate shown in fig. 16. This has a nickel-plated brass framework, and the legs and handles are of attractive design. The top is of polished heavy-gauge aluminium and is arranged to slide off to give access to the elements. The plate is made in two sizes; the smaller is 14½ in. by 9 in. (loading 150 W) while the larger measures 24 in. by 12 in. (loading 300 W).

Fig. 8.—The Jackson "Safety-Switch" Kettle.

Fig. 9.—A "Smoothwell" Iron with Signal Lamp.

Fig. 10.—The "Aspiron" Suction Cleaner.

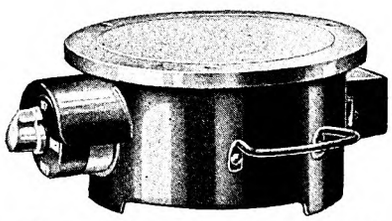

Fig. 11.—An "Xcel" Boiling Plate.

Fig. 12.—An "Elect" Coffee Percolator.

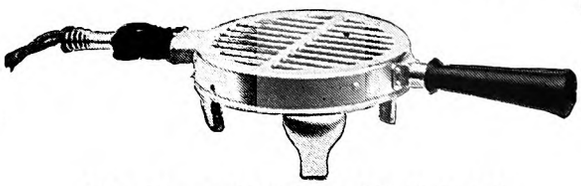

Fig. 13.—A "Universal" Hot-plate.

Fig. 14.—An "A.E.G." Tea Kettle.

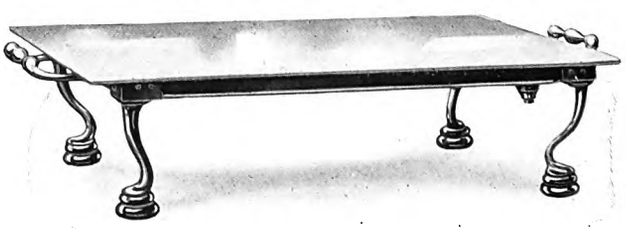

Fig. 16.—An Electric Warming Plate.

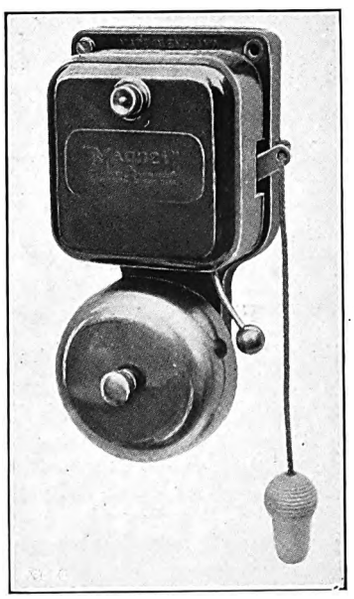

Fig. 15.—A "Magnet" Bakelite Bell.

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Industrial Electric Heating.

A commentary on the progress made in the design, construction, and operation of electric furnaces during recent years.

By E. P. BARFIELD, A.M.I.E.E.

THE progress industrial electric heating has made in this country during the past ten years is worthy of note. In the year 1919 the comparatively small demand for electric furnaces for the heat treatment of steel parts could be usually met by a furnace having a chamber some 5 or 6 in. high, 7 or 8 in. wide, and a length of about a foot. As time went on

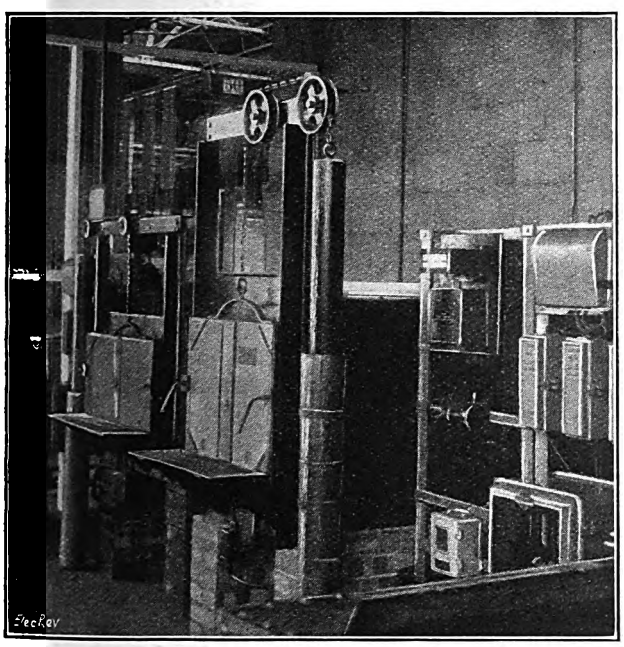

Fig. 1.—Carburising Furnaces at the Works of London General Omnibus Co., Ltd.

those small equipments commenced to make their own worth and left a good impression in very many works up and down the country as to reliability, cleanliness, economy, and other features, not the least important of which was improved production. It must be borne in mind that as electric furnaces are most frequently purchased and used by persons with only a mechanical training and no electrical experience it is only natural that these individuals should not be acquainted with the ideal heating conditions to be obtained by the use of electricity. Uniformity of heating and simplicity of temperature control, two points of great importance in engineering production, made themselves apparent to the mechanical mind from the smaller units already installed, and as time went on, the size and scope of furnaces and other industrial units heated by electricity has continued to increase. Slow as the progress may have been, it is worthy of note that electric furnaces of British design have been adopted by and manufactured in several different countries.

As the dimensions of electric furnaces increased, the refractory makers have had to keep pace, and many fresh problems have presented themselves to the manufacturers of refractories, who have tackled numerous difficulties with remarkable vigour and success. The most successful enterprises in this country are undoubtedly those that have been built up from small beginnings, and so with industrial electric heating the construction of large equipments is carried out with confidence and certainty of results based on experience of smaller units and a knowledge of what to avoid in order to obtain successful performance. It will be appreciated that large furnaces working continuously night and day at a temperature of, say, 900 deg. C., for work such as carburising, are put to considerable strain, for in addition to long runs at comparatively high temperature, there is the added effect of the frequent heating up and cooling down, and the consequent expansion and contraction of all parts subjected to heat, and beyond this the effect of soot and gases given off, and last, but equally important where iron boxes are used, is the question of scale. All these difficulties have, however, been satisfactorily overcome. Fig. 1 shows two furnaces installed in the works of the London General Omnibus Co., Ltd., Chiswick, fitted with automatic temperature control, time switch, and thermal or automatic fuses. The furnaces are perfectly automatic, with the exception of charging and discharging, which is in this case done by hand. A better idea of the internal construction is obtained from fig. 2, which clearly shows the chamber. It will be observed that the heating elements are totally enclosed in the fire bricks, thus guarding against mechanical damage and protecting them against the effects of scale. It should be observed that it is customary to fit all large furnaces with an automatic single-pole door switch, so as to render the elements " dead " when the door is opened. Such switches, however, still have the thermal fuse " alive," which is a source of danger however well it may be mechanically guarded. To over-

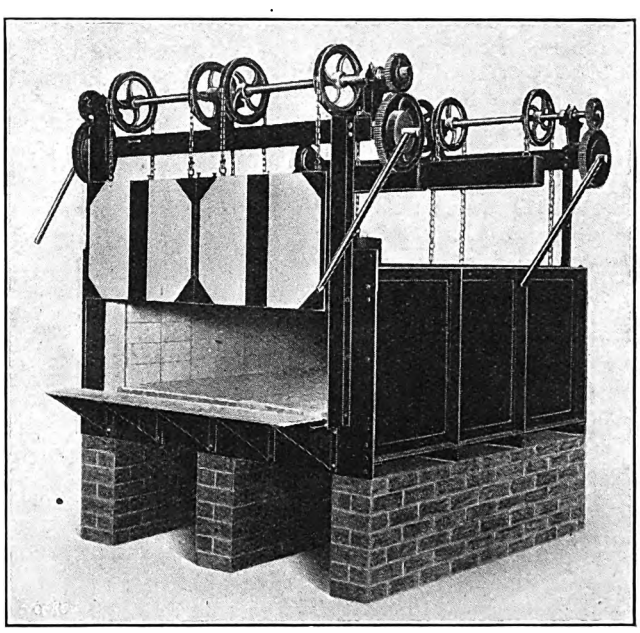

Fig. 2.—Chamber of Carburising Furnace.

come this danger a simple expedient in the form of a double-pole switch has recently been made the subject matter of a patent. Reference to fig. 4 shows the wiring for the automatic temperature control, time switch, thermal fuse, and automatic door switch, on a 400-volt 3-phase supply, for an electric furnace measuring 6 ft. 8 in. by 6 ft. by 1 ft. 8 in. high.

When large and heavy loads are concerned, hand or

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electrically operated charging machines are employed. Fig. 3 depicts the most modern Gibbons Van-Marle charging machine, on which are mounted the motor and

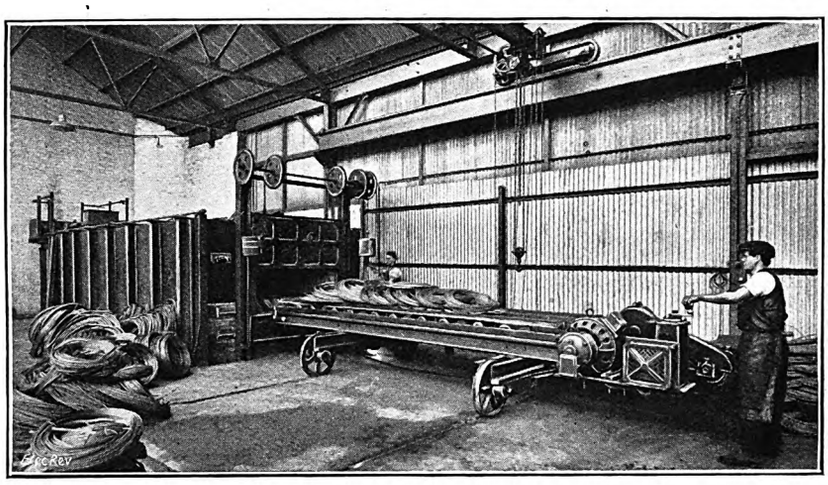

Fig. 3.—Charging Machine, showing Electric Motor and Controller.

controller. Experience in actual working has shown that a machine-charged muffle or furnace has the following advantages over those loaded by hand: (1) the heavy labour entailed in loading and unloading a hot furnace with hand tools is saved, and the men work under far more comfortable conditions; (2) to load or unload a furnace with hand tools generally takes from 10 to 20 minutes, according to its size, and a large amount of heat escapes during this time through the open door, with a consequent wastage of fuel—with such a machine either operation can be carried out in less than a minute, saving heat losses and giving the furnace an increased output per working day; (3) when a long furnace is charged by hand it may happen that the back end is only partially loaded, while the end near the door is overloaded and its material underheated; when a machine is used, the load is evenly distributed along the whole length of the furnace floor—even and correct annealing and heating of all the material is therefore possible; (4) there is less wear and tear on the sides and floor of the furnace chamber, owing to the even loading and distribution of the material, and a considerable saving in furnace repairs is effected.

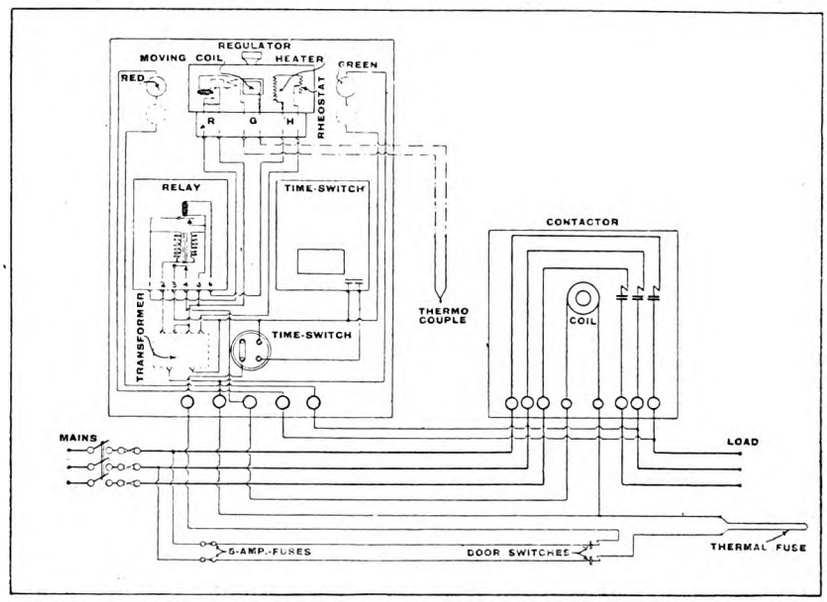

Fig. 4.—Wiring Diagram of Automatic Temperature Controller on 400-V 3-phase Supply.

Insofar as actual work produced is concerned, reference has so far only been made to carburising, but similar types of electric furnaces are used for the various heat treatments of metals, both ferrous and non-ferrous, and for enamelling, &c. When conditions require, or the nature of the article demands them, rotary hearth furnaces may be employed, or in other cases pusher-type or progressive furnaces. Such types, however, demand careful consideration from the purchaser's point of view, as in this country it is often expedient to install two or more small furnaces rather than one large one, but in this, like so many other cases, it is best for the potential user to visit a furnace maker who has had sufficiently long experience to advise him as to the best method to adopt. The temperatures covered by the types of furnaces having nickel-chromium rod, wire, or grid elements, so far touched upon, do not usually exceed 1,000 deg. C., and are consequently unsuitable for hardening high-speed steel or for pottery kilns, which require temperatures of from 1,250 deg. C. to 1,300 deg. C. Such temperatures being too high to permit the use of nickel-chrome as the heating medium, it is necessary to adopt rods of carborundum. The disposition of these rods in the furnace depends mainly upon the size of the chamber. In small sizes it is usual to fit the heaters in the roof only, but in larger sizes, the elements may be fitted in the walls only.

The application of carborundum or silicon carbide as a means of heating electric furnaces for temperatures above 1,000 deg. C. has been common practice for some time past. Resistor rods or bars of this material have, however, the great disadvantage that at a temperature, *e.g.*, in the neighbourhood of 1,300 deg. C., the carborundum partially dissociates and oxidises, causing the bars to increase continuously in resistance with use. The effect of this increasing resistance is that, when the bars are new, some means have to be adopted to reduce the power input to the furnace to guard against the rate of heating, and when the bars are old the rate of heating becomes so diminished that the bars have to be discarded before they are really worn out. It is of course possible to regulate the rate of heating by inserting in series with the elements a regulating resistance which the operator can cut out step by step as the

Fig. 5.—Pit-type Oven for the Heat-treatment of Duralumin.

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resistor bars age. This, however, demands the operator's attention and may require a degree of judgment that cannot always be depended upon; nor

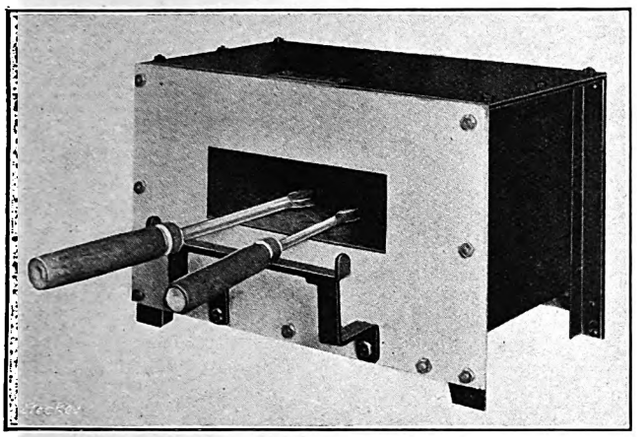

Fig. 6.—Solder Bolt Heater.

would such a method of control be suitable in a hardening shop. In order, therefore, to take this regulation

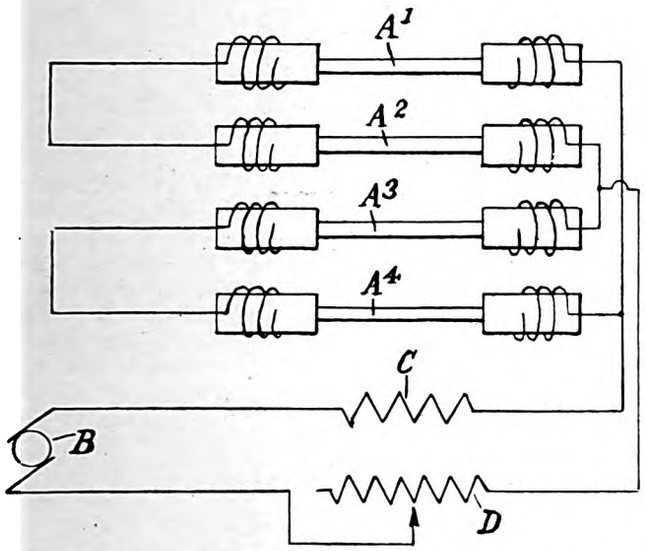

Fig. 8.—Wiring Diagram of Ballast-resistance Control with Carborundum Resistor Bars.

out of the hands of the operator, a fixed or ballast resistance is inserted in series with the resistor bars. The effect of this ballast resistance is to tend to equalise the power input to the furnace as the bars age and increase in resistance, and to diminish the variation in output between the new and old conditions. For example, suppose that the ballast resistance is made equal to the initial resistance of the elements, then, as the furnace resistance increases with age, the current falls and the e.m.f. at the furnace terminals rises, so that the diminution in power output to the furnace is considerably less than it would be without any ballast resistance.

To take a specific case of a resistor bar having an initial resistance of 100 ohms, increasing with age to 200 ohms, and an applied e.m.f. of 100 volts, the power consumed initially is $100^2/100$ and finally $100^2/200$, *i.e.*, 100 watts and 50 watts, corresponding to a reduction of 50 per cent. If now a ballast resistance of 100 ohms is connected in series with the furnace resistor, and the applied e.m.f. is doubled, the initial e.m.f. across the furnace will be 100 volts and the final e.m.f. two-thirds of 200 = 133 volts. The power consumption will be in the two cases $100^2/100$ and $133^2/200$, or 100 W and 88 W, a diminution of 11 per cent. only in the heat output of the bar. If the ballast resistance were only 50 ohms, the total initial e.m.f. required would be 150 volts to give 100 volts across the furnace; the final e.m.f. across the furnace would be 4/5 of 150 = 120 volts, and the power consumptions $100^2/100$ and $120^2/200$, which are 100 W and 72 W, a diminution of 28 per cent. With an increase in the resistor resistance of 65 per cent. the fall in power consumption is only 20 per cent., so that, with this arrangement, it will be realised by those skilled in the art that there is considerable practical utility.

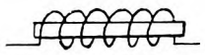

Fig. 7.—Alternative Ballast Impedance.

The ballast resistance may comprise an ordinary open coil, but it is obvious that a reactance or choking coil may be substituted with a saving of power, where the source of supply is alternating current. The method is illustrated in figs. 7, 8 and 9.

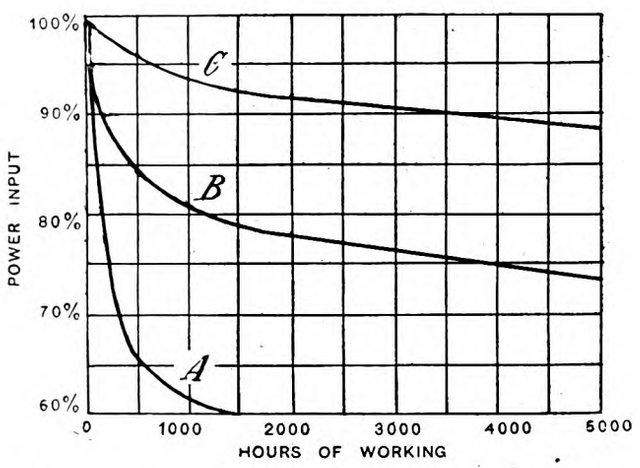

Fig. 9.—Relation between Energy Input and Working Hours for Non-ballast and Ballast Control.

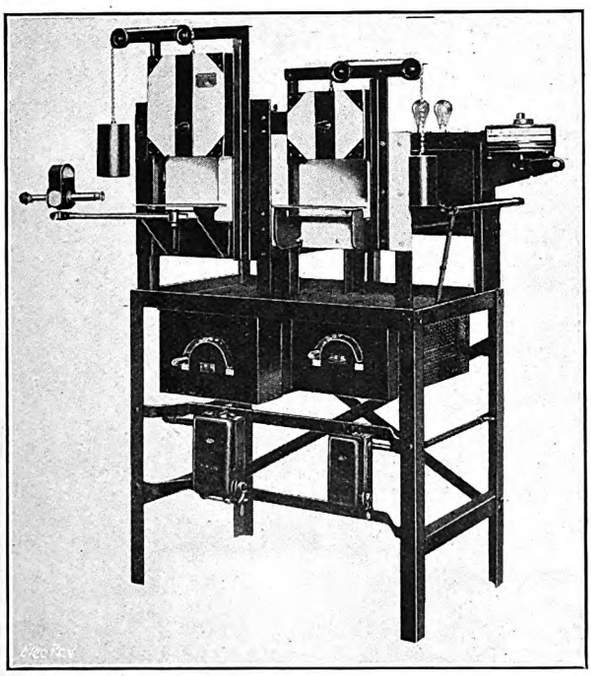

Fig. 10.—Steel-hardening Furnace Installation with Balancing Resistance.

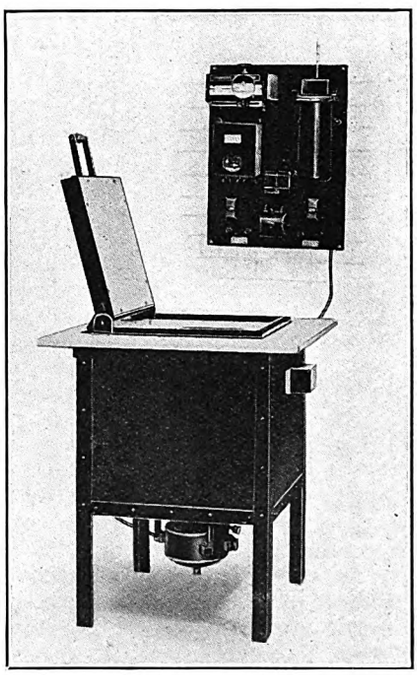

Fig. 11.—Air-tempering Oven with Fan in Base.

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Turning to fig. 8, this indicates four resistor bars of carborundum of ordinary construction, to which the line contacts are made. The bars A1, A2, A3 and A4 are shown by way of example in multiple series. The current is derived from a generator B, and passed on the one hand through ballast resistor C arranged in series with the bars, and on the other hand through a controlling rheostat D.

In fig. 7 is illustrated an alternative form of ballast impedance, comprising a choke coil with an iron core for use with alternating current. Fig. 9 depicts three curves, A, B and C, showing the relation between power input and hours of working for furnace bars under ordinary or usual conditions, A showing the case where no ballast resistance is used, B where the ballast resistance is 50 per cent. of the furnace resistance, and C where the ballast resistance is 100 per cent. of the furnace resistance. It will be seen from curve A that with a simple furnace the power input drops sharply on starting the furnace, as the furnace resistance curve (which corresponds to the inversion of curve A) rises very steeply with carborundum from the initial stages of use, as is well known. Assuming the useful life of the bars to be confined to the maintenance of 90 per cent. of the initial input, it will be seen from curve A that this point is reached after less than 50 hours working, and that 80 per cent. of the power input is reached after 100 hours working.

With ballast resistances of 50 per cent. and 100 per cent. of the furnace resistance, curves B and C, respectively, these time periods are much exceeded, the corresponding readings being tabulated for the sake of convenience in the following table :—

	When ballast resistance is:—		
	0.	50% of furnace resistance.	100% of furnace resistance.
Hours of working before power input falls to 90%	less than 50	200	3,700
" " " 80%	100	1,400	very high.

It should be stated that the foregoing method of balancing is the subject matter of patents in this country and abroad.

Fig. 10 shows a complete furnace installation with balancing resistance. After steel parts have been hardened their brittleness is reduced by re-heating to a lower temperature. Various types of tempering baths and ovens are employed for this purpose. In baths containing molten salts or oil, depending upon the temperature required and the nature of the article to be tempered, a large quantity of the material employed is taken out and lost each time the finished work in the bath is removed, as the liquid medium adheres to the hot pieces. Such losses may and do become in many instances a serious item of cost, and in addition the clearing of the pieces to remove all trace of salt or oil incurs additional expense. Air tempering ovens are now largely superseding salt and oil baths, and the introduction of a special type of fan in the base of the oven greatly increases the output and insures the uniform heating of all the pieces suspended or placed in a perforated metal basket. Fig. 11 shows a tempering oven of this type; the fan motor can be clearly seen in the base of the oven. The internal dimensions of the oven illustrated are about 24 in. by 24 in. by 12 in., and the loading is 3 kW. The working temperature is automatically governed by the controller mounted on the panel fixed to the wall above the oven. A modification of the foregoing is depicted in fig. 5. This equipment is a pit-type oven for the heat-treatment of duralumin parts for aircraft work. The vertical heating elements are fitted behind the perforated metal uprights seen in the photograph. The lid of this pit oven is removed by a jib. Temperature control is automatic.

A useful industrial heating unit for workshops, garages, telephone exchanges, &c., is a solder bolt heater—in reality a small rectangular brick muffle with a chamber 6 in. deep by 5½ in. by 1¾ in. high, provided with a metal interior, capable of heating five 1½-lb. irons. The loading is 1 kW, see fig. 6.

An increasing number of industrial heating appliances is being manufactured for specialised industries; lead pots for plumbing, white-metal baths for bearings, continuous kilns for potteries, and metal pots for linotype machines are only a few of the numerous appliances now supplied to meet the requirements of various trades.

Industrial Electric Furnaces.

Illustrations of and Notes on Selected Items from Manufacturers' Products.

ALTHOUGH the electric rotating annular-hearth furnace has been in use for some years in America, it is believed that the one installed at the works of Messrs. Moss Gear Co., Ltd., by Birmingham Electric Furnaces, Ltd., fig. 1, is the first of that type installed in this country. In general design it is similar to the American furnaces, but there are several special features included which are unique to the "Birlec" furnace. The furnace was designed primarily for the re-heating of crown wheels. The hearth is in the form of a continuous annular ring which is driven by an electric motor through reduction gearing and variable-speed mechanism, all totally enclosed. It is possible to vary the speed of the hearth from one rotation in 15 minutes to one rotation in two hours, and in this way the furnace can be used for the heat treatment of a large variety of parts.

The part to be heated is charged on to the hearth through a small door. On completing a rotation the part is discharged through a door adjacent to the charging door and quenched. As in this process each crown wheel has to be quenched in an oil-cooled press, removal from the furnace to the press is by hand. Both doors are opened by means of foot pedals and are self-closing. A baffle wall

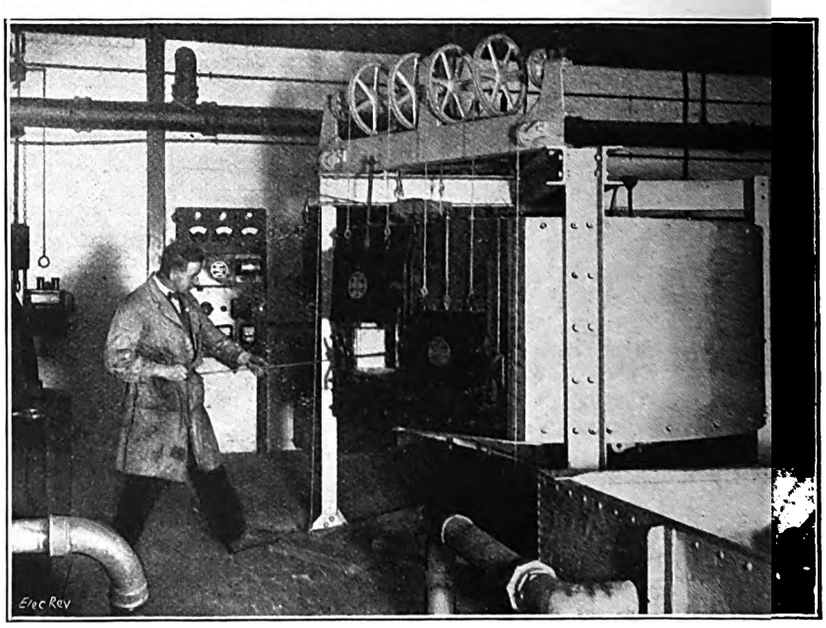

Fig. 1.—"Birlec" Rotating Annular-hearth Furnace.

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extends across the hearth between the two doors to prevent the ingoing charge cooling the heated parts. On the discharge side of the baffle wall, a safety device is fitted which stops the hearth rotating and lights up a lamp should the operator fail to discharge the part. This prevents an accumulation of parts at the discharge door, which would eventually cause considerable damage.

The entire hearth is covered with nickel-chromium plates, which are ribbed to facilitate the removal of the charge. The heating elements, which consist of very-heavy section nickel - chromium strip, are located around the complete circumference of the inner and outer walls and in the roof near the two doors. They are divided into three independent zones, each zone being automatically controlled. By this means it is possible to set the first two zones at a higher temperature than the third or soaking zone. This latter zone acts more as an equaliser and brings all the charge to a uniform temperature. The output of the furnace is from 2 to 3 cwt. per hour, according to the mass of the charge. A careful test was recently made, and it was found that one man was handling 32 crown wheels, each weighing 7.1 lb. per hour, the energy consumption being 20.6 units per hour. This is equivalent to approximately 200 units per ton, or 11 lb. of material treated per unit consumed. With current at 0.6d. per unit the cost is 0.054d. per lb.

The Metropolitan-Vickers Electrical Co., Ltd., and the Electric Furnace Company, Ltd. (who are sole licensees for the British Ajax-Northrup patents) have entered into an agreement whereby each company has the right to manufacture and supply coreless induction furnaces incorporating the Metropolitan-Vickers and Ajax-Northrup patents. The furnace illustrated in fig. 2 is installed in the Sheffield works of Messrs. Vickers, Armstrong, Ltd. It is designed for melting 5 cwt. of steel at one charge, for which capacity designs have been standardised, while development work is proceeding on commercial equipments of larger capacities.

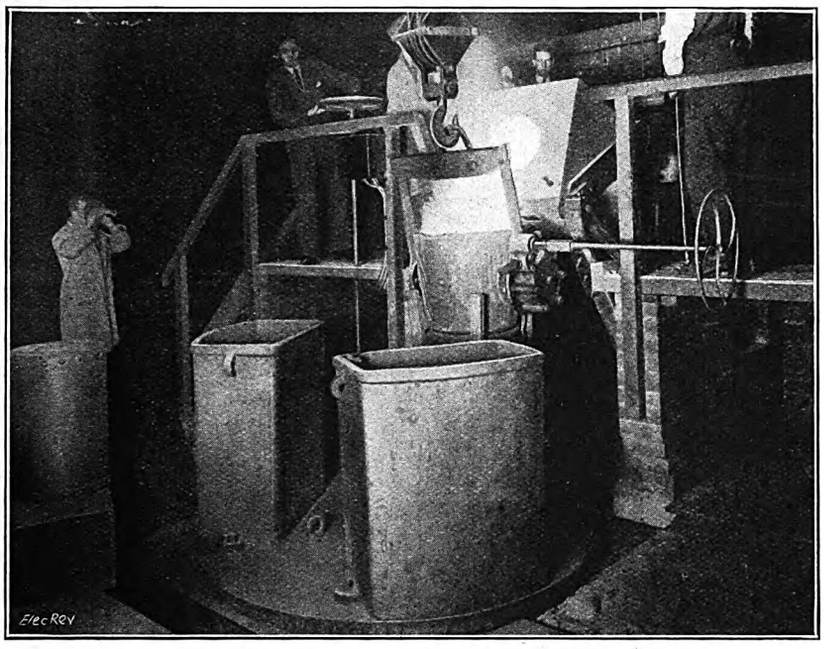

Fig. 2.—Met.-Vick. Induction Furnace at Vickers-Armstrong Works.

One important result of the research work carried out is that three important fundamental facts have been established, *viz.*: for any given capacity of furnace and resistance of charge a well-defined alternating current supply frequency exists, below which the efficiency falls off very rapidly and above which the efficiency is nearly constant; secondly, as the capacity of the furnace is increased the frequency can be reduced; and thirdly, successful working can be obtained at frequencies very much less than those hitherto considered necessary. Thus for melting steel in 5-cwt. charges it has been found that the frequency can be reduced to 500 cycles, which makes it possible to substitute for the costly high-speed high-frequency generators hitherto employed low-speed low-frequency generators of increased reliability, higher efficiency, and considerably reduced cost, while for melting brass and other low resistance non-ferrous metals it has been found possible, in a demonstration furnace of 5-cwt. capacity, to obtain successful operation using a frequency as low as 50 cycles, obtaining current through a transformer direct from a standard supply system and thus entirely dispensing with the motor-generator set.

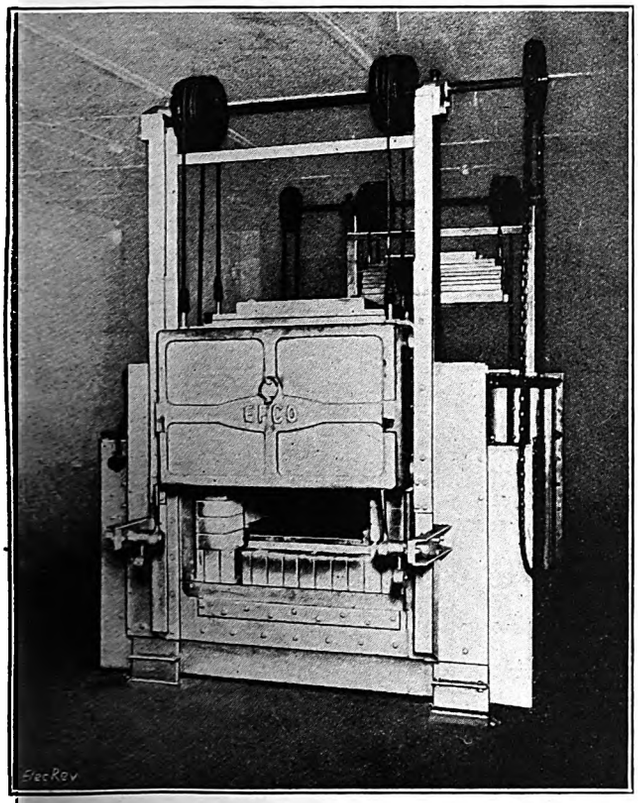

Fig. 3.—Double-ended Furnace for Precious Metals; Electric Furnace Co.

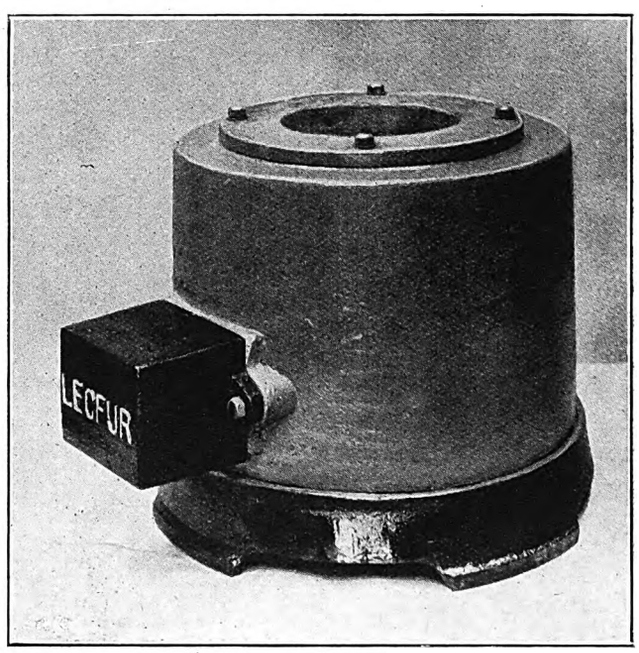

Fig. 4.—" Lecfur " Melting Pot; 3.2 kW.

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The furnace proper consists of a specially constructed water-cooled inductor coil mounted in a strong wooden box supported on trunnions of non-magnetic cast-iron, and tilted by an electric motor on an axis about the lip of the crucible. Hand-operated tilting gear is also provided. The crucible is directly lagged into the inductor with ganister or zircon sand, and supported on a concrete block. A specially important feature of all M.V. induction furnaces is the strong inductor coil, which is made of heavy-section copper bar wound on edge, and fitted on the outside of the coil with water-cooling pipes which, therefore, are isolated from the molten metal by a thick wall of copper in addition to the lagging of sand. The completed coil is suitably insulated and finally heated under pressure, thus forming in effect a thick copper cylinder, which surrounds the crucible and can readily be clamped in position. The supply leads, of flexible cable, are taken to a switch at the bottom of the box, the switch being connected to the ends of the coil and also to a tapping, thus making it possible to employ the whole or part of the coil, and so regulate the temperature of the furnace. Water connections are made at the back of the furnace by flexible rubber hose. Clay or plumbago crucibles may be used, the former being valuable where carbon must be kept down to a minimum, as, for instance, in stainless iron and in some types of stainless steel. The number of charges per crucible varies from 8 to 12 in the case of clay, and from 12 to 20 with plumbago crucibles, the number depending on the kind of steel melted. If used for 12 hours per day, with a daily output of not less than 2 tons, the total cost per ton, including depreciation, interest on capital, labour, power, and crucibles, would be approximately £5 15s., this value being based on the following allowances: depreciation, ten per cent.; interest, five per cent.; yearly output, 550 tons; labour, £11 per week; overall power consumption, 750 kWh per ton at a cost of 0.5d. per unit; and crucibles, 84s. each, and an average of 12 heats per crucible.

The following notes concern productions of the Leeds Electrical Constructional Co., Ltd. The "Lecfur" electric melting pot, type L.100, fig. 4, is designed for a loading of 3.2 kW, but the loading may vary according to the voltage of supply. The furnace will melt a charge of 100 lb. of lead in 50 minutes from cold, and if melting is continued after the first melt, the rate will be 2½ melts per hour, *i.e.*, 250 lb. of lead melted per hour. If it is desired to retain the lead in a molten state for some time without pouring, it can be maintained in this molten state on ¼ heat. It will therefore be seen that if the user is paying 1d. per unit for his current, it is costing him a fraction over 3d. for melting 250 lb. The times taken for melting type metal and babbitt metal vary according to the composition of the metal. The advantages of the "Lecfur" electric melting pot are that there are no gas fumes or products of combustion, comparatively little loss of heat by radiation, and therefore the attendant is working under more comfortable and clean conditions. The furnace connections are fully protected, and the furnace can therefore be placed in any position, whether it be an upper floor or elsewhere, without risk of fire. These "Lecfur" electric melters are made in a variety of sizes for discharging either by means of a ladle, as in the case of the illustration, or in some cases by tilting, or by means of a valve in the bottom of the pot.

The illustration, fig. 3, depicts a double-ended furnace produced by Electric Furnace Co., Ltd., for the heat treatment of precious metals. Its loading is 27 kW. The chamber dimensions are 9 ft. 7½ in. long by 2 ft. wide by 9¾ in. high. It is installed in the works of Messrs. Johnson Matthey & Co., Ltd., London.

(*To be continued.*)

Large Cooking Equipment.

Features of Recently Completed Electrical Installations.

In these days of electrical domestic cooking development, one is apt to overlook what is being done in connection with electric cooking on the larger or industrial scale, such as in bake-houses, restaurants, and so on. The following notes on a few selected installations will, we hope, serve as a reminder that there is a very large field for development in the directions indicated.

The illustration in fig. 2 is of two single-deck ovens installed by the Artofex Engineering Works, Ltd., in the bakery of Messrs. Randall Slade, of South Norwood. Each oven has baking chambers measuring 8 ft. by 5 ft. 8 in., this size being decided upon so as to accommodate a definite number of standard baking trays. The maximum loading per single-deck oven is 16 kW. The elements are located externally to the baking chamber, but

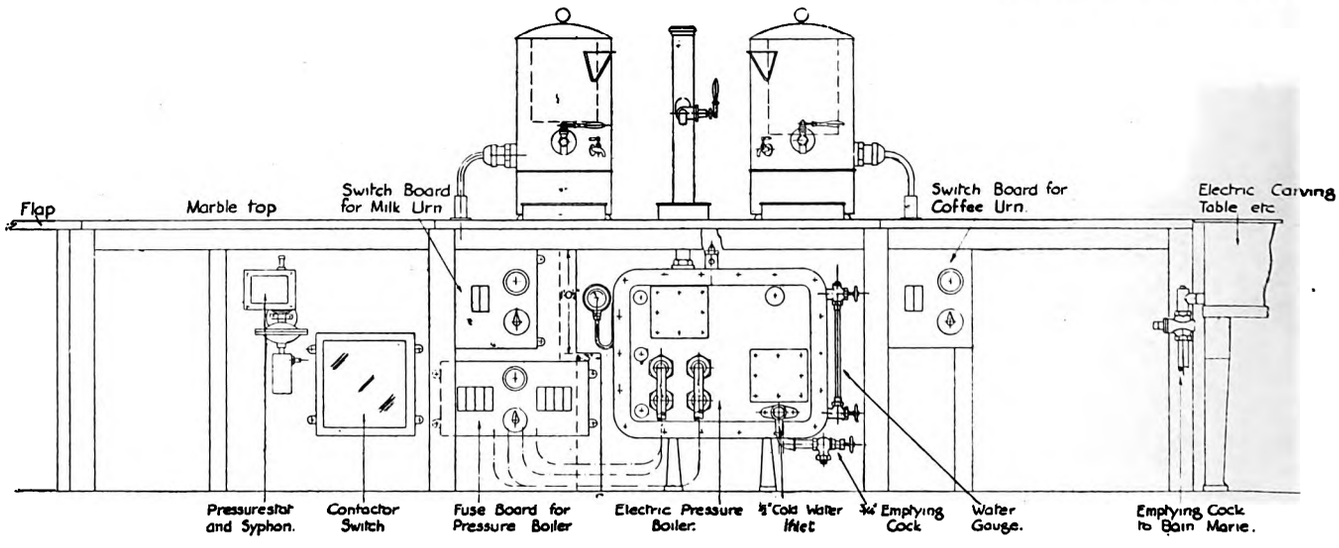

Fig. 1.—Arrangement of Cooking Equipment at Nottingham Exchange Building.

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adjacent to the top and bottom thereof, and they have graded loading, so as to assure uniform temperature from back to front of the oven. The elements pass from left to right, and they are closely located, so as to assure direct radiation of heat. The switch controls are arranged in such a manner that one-third of the elements can be switched on to provide low heat; the remaining two-thirds can be switched on to provide medium heat; or the entire elements can be switched on for full heat. This method is claimed to be more satisfactory than the series-parallel control.

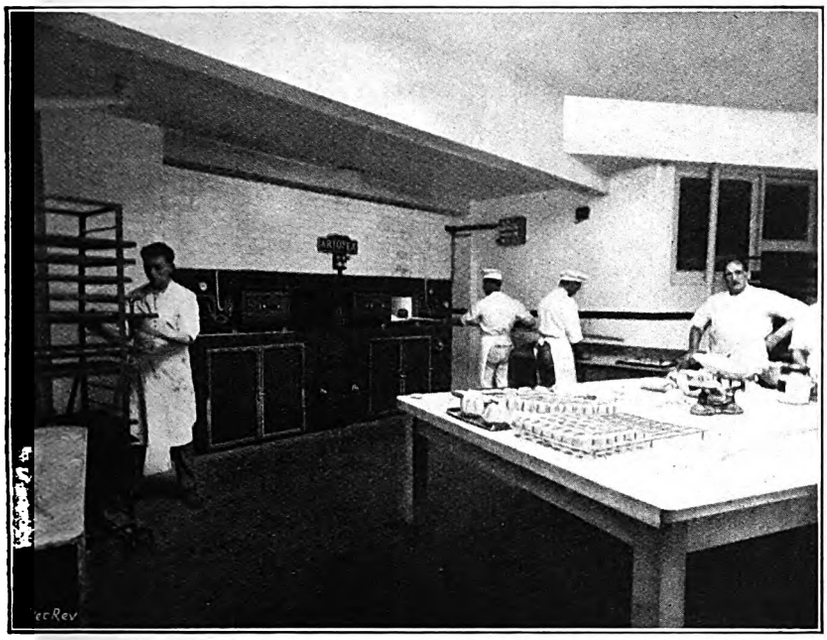

Fig. 2.—" Artofex " Single-deck Ovens.

The experience of the Artofex Co. is that by locating the elements adjacent to the baking chamber in its particular manner, the kW loading per square foot of baking surface is reduced by comparison with other methods, and the ovens are claimed to be more economical. Rotary switches of a special design are employed, and this particular installation had to be so balanced that the elements on the top of one baking chamber and the elements on the bottom of the other baking chamber had to be put on one side of the system and the remaining elements balanced on the other side, so that it would not be possible to use one oven alone and cause out-of-balance on the supply system, which, being Croydon, is 400 volts, 3-wire, single-phase.

The second installation to which we refer is another " Artofex " oven, fig. 3, employed by Mr. Garner, of Wembley. It comprises a two-deck 8 ft. by 4 ft. electric oven having a maximum loading per deck of 12.5 kW. The arrangement of elements is identical to that for the oven first described. Steam ejectors to the ovens are provided, so avoiding the necessity of external steam apparatus. This oven is on the 418-V, three-phase supply, the elements are wound for 415 V, and the two ovens are balanced across the three phases. This installation is particularly interesting, in that by installing it in the original coal store, the floor space, which is now used as a bakery, has been recovered; it was previously used for accommodating a steampipe oven. Both the " Artofex " installations referred to have superseded steampipe ovens, which were coke fired. " Zed "-type fuses are used in all " Artofex " installations.

That the reputation won by " Magnet " electric cooking appliances of the General Electric Co., Ltd., is not confined to this country is attested by the fact that among many recent overseas orders, the head office of the British General Electric Co., Ltd. (Australia), reports additions to the installation at the Hotel Kosciusko, in the Australian Alps. These additions comprise a 4 ft. by 4 ft. baking oven, a double-pan fish fryer, a griller, and a boiling table, all selected from the standard " Magnet " range. The hotel in question is one of the most exclusive in the State, is 60 miles from the railway, and is situated 7,000 ft. above sea level in a popular winter resort. It has its own hydro-electric plant for the supply of electricity for both lighting and cooking purposes.

When Mr. G. R. Bailey, of High Street, King's Heath, Birmingham, had his G.E.C. " Magnet " baking oven installed some time ago, representations were made to the Birmingham Electric Supply Department to induce it to reduce the charges for night running. The undertaking agreed and fixed the charge at an inclusive one of 0.6d. for night running, the charge for day running being ¾d. per unit. The business of Mr. Bailey, who is president of the District Baker's Manufacturers' Association and a member of the National Council Association, is largely confined to confectionery, and he now has an entirely electrical bakery, no gas, oil, or coke being used in it. His consumption averages over 1,000 units per week. The equipment supplied to him by the General Electric Co., Ltd., comprises a double-deck 8 ft. by 4 ft. oven, a single-deck 4 ft. by 4 ft. oven, an aluminium proving cupboard with steam producers and dry heat, a doughnut fryer, a scone plate, 3 ft. by 2 ft., and a boiling ring for the preparation of fondant mixtures.

The following notes concern an installation supplied by Messrs. Benham & Sons, Ltd., to the new Nottingham Exchange Building. It will be noticed, fig. 1, that the apparatus is designed as an integral part of a large fitment which includes a 3 ft. 6 in. bain marie and an 8 ft. electrically heated carving table. The boiler of the tea- and coffee-making apparatus is of the pressure type, *i.e.*, that in which only boiling water can be delivered. The urns for making the coffee have water jackets which are filled and heated separately by immersed elements, but in other types these jackets are supplied through suitable pipework with steam from the boiler. The latter method is not to be recommended

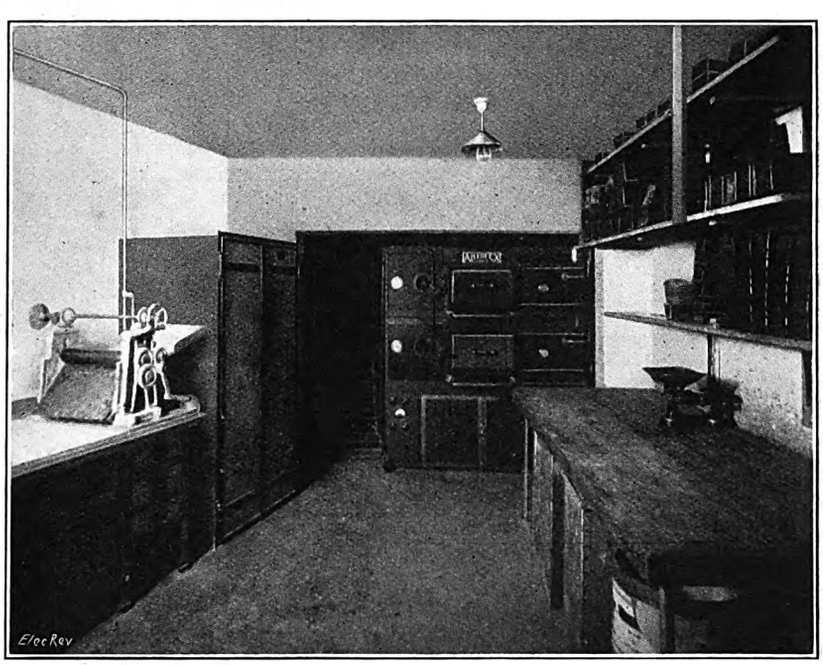

Fig. 3.—Two-deck " Artofex " Oven.

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always, as it takes away from the delivery capacity of the boiler.

The pressure boiler, or, as it is sometimes styled, fountain boiler, is made of heavy cast-iron in two main pieces bolted together. The only moving part of the boiler is an internal ball cock valve, and this is attached to and withdrawable with the cover. The cover of the boiler has also two bolted-on plates, one for inspection

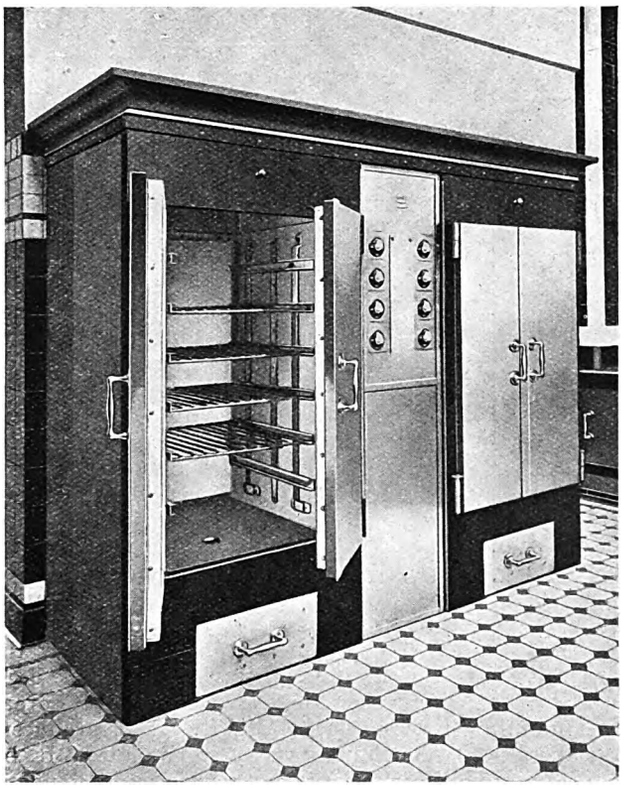

Fig. 4.—" Carron " Roasting Ovens.

of the portion where the elements are fitted, while the other is for making adjustments which may be necessary to the ball cock valve. The boiler is mounted upon feet, and has a safety valve, cold-water feed valve, and water and steam gauges. Heating is effected by four elements of the immersed kind, each of 2.5-kW loading.

The boiler works automatically, and is controlled by a pressurestat (not thermostat) adjusted to maintain the steam pressure at approximately 4½ lb. per sq. in. On the left is a pressure-operated mercury switch which is connected directly to the steam portion of the boiler, while its calibration is effected on installation by the aid of the steam pressure gauge. This pressure-operated switch controls the solenoid circuit of the contactor switch, which actually carries the current which heats the water. All elements are fused on both sides, although in three-phase systems, as a rule, where the electrical supply is taken from one phase to neutral, only one fuse is really required. There is no boiler main switch locally; the operator merely closes a small switch which energises the control circuit, and a pilot light is fitted which lights when this switch is closed.

An unusual feature in connection with the safety of the boiler is to provide that the current through the elements shall be automatically switched off in the event of the diaphragm of the pressurestat failing. The failure of the diaphragm by leakage in the ordinary way would prevent the supply from being switched off, resulting in a rapid rise of steam pressure. The safety valve is, of course, necessary in a fitting of this kind, but a device which diagnoses its own trouble is always welcome, beside being an additional measure of safety.

Other electrical fittings at the Nottingham Exchange are a 2-compartment roasting oven, each compartment measuring 24 in. by 24 in. by 46 in. inside, a double-compartment griller, each section measuring 24 in. by 12 in., and a hot cupboard 7 ft. by 2 ft. 3 in.

There is much of interest in the electrical cooking equipment which is installed at Imperial Chemical House, the new headquarters of Imperial Chemical Industries, Ltd., by Messrs. Richard Crittall & Co., Ltd. Fig. 4 shows two roasting ovens with internal dimensions of 24 in. wide, 28 in. deep, and 52 in. high. The ovens are lined internally with white-porcelain enamelled iron sheets and element guards, lagged with non-conducting material; the fronts are of cast-iron and each oven is provided with double side-hinged insulated steel doors faced with " Silveroid." The shelf supports are easily removable to allow access to the elements and back of the ovens. Each compartment is loaded at 15 kW (maximum), and the elements are controlled by 3-heat switches, " Zed " fuses being arranged in each circuit.

An electrically-heated pastry oven has two compartments, each 38 in. wide by 32 in. deep by 11½ in. high, inside. The body is constructed of cast-iron and sheet-steel, and is double cased and lagged. The heating element in each compartment is loaded at 6 kW (maximum). The electric cooking apparatus at Imperial Chemical House also includes a fish-frying suite 6 ft. long by 2 ft. 3 in. wide by 6 ft. 6 in. high, overall. It has three welded-steel pans, each 18 in. by 18 in. by 6 in. deep inside, and a sheet-steel canopy enamelled inside and outside. Heating elements under each pan have approximate loadings of 7.5 kW each. A double-compartment electric grill is loaded at 10 kW per compartment. The apparatus at Imperial Chemical House was made by Carron Company.

An interesting cooking installation is that at King Edward's School, Witley, by the Jackson Electric Stove Co., Ltd. It includes a three-tier bread oven, a four-plate boiling table, two fish fryers, a large roasting oven, and a two-gallon urn. The oven, fig. 5, has replaced a coal-fired equipment, resulting in a saving of floor space of about 100 sq. ft. The floor-space measurements are 4 ft. 9 in. by 3 ft. 3 in. While the

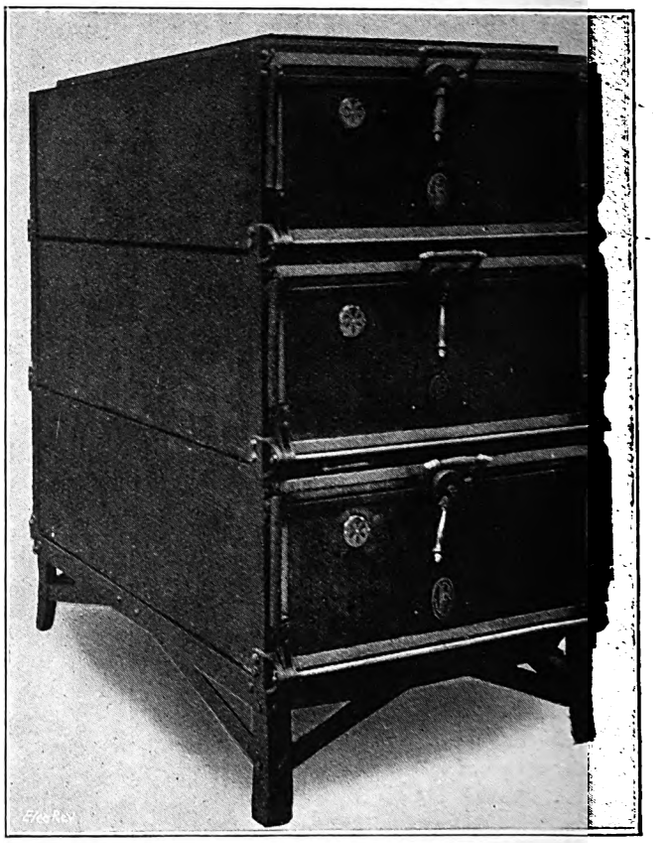

Fig. 5.—" Jackson " Three-tier Bread Oven.

baking area, 40 sq. ft., is only about half that of the coal-fired oven, the electrical equipment results in more and better work in the same time. Each of the tiers measures 3 ft. wide by 4 ft. 6 in. deep by 12 in. high, and will accommodate twenty 4-lb. loaves. Each tier is loaded at 8 kW.

Each compartment is provided with top and bottom heat and the elements are three-heat controlled. Use is made of standard " Jackson " fire-bar heaters with solid iron bus-bars fixed externally to the sheet-metal trays forming the top and bottom linings of the ovens.

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Installation Work for Women.

A Plea for the General Employment of Women outside Purely Merchandising Spheres.

By MARGARET M. PARTRIDGE, B.Sc., A.M.I.E.E.

IN years gone by much was said about the wrongs women did to men by entering professions that had always been men's special preserve, by undercutting their wages, and, as it was sometimes expressed, by taking the bread from the mouths of their starving wives and children. Feeling ran high and many foolish and bitter things were said on both sides.

Though I believe we have reached an age of more sanity and clearer thinking, the controversy on the question of women's right to enter certain professions is not yet quite dead. I feel, therefore, that this article of mine may be considered somewhat controversial and, though the majority of men now admit that women may be a help to an industry rather than a menace, there are still a few die-hards who will read it with distaste.

Four or five years ago I was commissioned to report upon the chief types of electric vacuum cleaner then on the market. I spent some weeks visiting showrooms and factories, seeing demonstrations, and making tests, but it was remarkable that not in one single showroom or test-room did I meet a woman demonstrator. I do not think such a thing could happen now, but in those dim and distant days, five years ago, I looked upon it as the natural order of things and did not feel surprised.

What is the present position of women in the electrical industry; what is their future position, and to what extent can they help on development?

The facts are that electricity as a factor in industry, in transport, in telephone and telegraph communication, both wireless and otherwise, has found its place and has proved itself a prime necessity, and the growth of the business of electricity supply to industry and commerce is merely a question of the prosperity, or otherwise, of the industry which is being served.

Electricity as a factor in domestic life has not yet proved itself indispensable, and only the gradual education of the whole population of housewives will achieve that end. It is usually agreed that the best educational agents for this purpose are women.

No woman really believes that any mere man can know how to use a cooker, or how much dirt accumulates on the dining-room carpet, however polite she may be to the young man in the electrical showroom. She is polite to him perhaps partly because she is naturally a polite person, but more likely because she thinks that he, being a man, has some wonderful knowledge about the inside of the monster she contemplates making her servant, and deference is due to a being who has mastered a subject she can never understand—and the natural, but quite unconscious, reaction of the salesman is to foster this belief in his superior knowledge of the electrical insides of his wares to balance his feeling of inferiority when he tries to tell his lady customer how long it takes to cook a joint in an electric oven. All this is a bad handicap to progress, and most merchants of domestic apparatus have now come to the conclusion that women on the sales staff are quite as necessary as men; that there are many occasions on which a woman will be able to explain some piece of domestic apparatus to an intending purchaser as an understanding equal in intelligence, when a man would fail to gain the confidence of his customer merely because he talked from a slightly different plane.

This fact, as I say, has been recognised so far as direct merchanting is concerned, but as yet few engineers have discovered the uses of women in domestic installation work, in canvassing for consumers, and in general development organisation; and yet the same natural circumstances and conditions, the same prejudices and fears, are in force in this field, and many women could be usefully employed in breaking down prejudice and building up new business in undeveloped areas.

My own experience leads me to believe that the rather timorous new consumer, the old lady deciding on the great adventure of purchasing a supply of electricity for the first time, much prefers to have a woman make the arrangements and do the work in the house than a man. Others, of course, feel more confidence in men, but the wise organiser will cater for all tastes and will find that he can increase his business thereby.

In general, it is the small householder, the woman with a tiny beautifully kept home, who so much prefers to do her business with another woman and dreads men trampling over her best carpets. It is difficult to explain why it is that these gentle souls so often met with in the little south country towns and villages find their fears of electricity more easily dispelled by women, but it is an undeniable fact.

"I'm so glad you have come deary. That nice young man with brown eyes has just been here and told me about the electricity, but of course I couldn't tell him just what I want in my bedroom, could I? . . . When I have the electricity put in, might I have those two young ladies who did Mrs. Brown's house? I don't want any men trampling over my house, if you don't mind, deary, and if you can manage it. I don't mean to say the young men aren't very nice, and I'm sure they do their best, but it is not just the same, is it deary? . . . If you'd just explain to me . . ."

I have not quoted an eccentric or extraordinary old lady, but just one of many hundred householders who will make good consumers and who, as they usually do all their own housework, will find electrical service a boon and a blessing almost unrealised by more fortunate or able-bodied persons.

It is not impossible to find women who can do house-wiring work. During the war there were many trained wirewomen and there are still a few working, but the wise employer will train his own wiring staff, for many reasons which will be obvious.

I have not yet mentioned the uses of women on way-leave negotiations, but everyone who has been responsible for negotiating wayleaves for any considerable length of time will readily agree that any human being, be it man, woman, or child able to tip the balance of decision favourably in the case of any undecided wayleave granter is a welcome ally and an aid to general progress. It would not be true to state that any one class of individuals makes the best wayleave negotiator, for it all depends on the person visited. I once obtained an essential wayleave from an uncompromising feminist by basely agreeing with her that the three men who had already visited her were, like all their sex, unreliable fools and rascals. I must say I shouldn't like to have to do that often, but those who have experience of the difficulties of getting wayleaves will readily agree that the end sometimes justifies the means.

Throughout this article I have dealt with the position of women and the work they can do in, and for, the electrical industry from the human side, rather than from the technical; but that is because it is on the human side that the uses of women are most evident. An employer buying brains or muscle pure and simple does not in the least mind the age, sex, nationality, or appearance of the vessel holding the brains or muscle he requires; but an employer buying social service must choose his vessel with care, and the wise man will choose some old, some young, some men, and some women, as only thus can he give in full measure the satisfaction required of him.

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Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Thermal Storage Water Heaters.

My letter in connection with Mr. Sims's article on "Thermal Storage-Water Heaters" does not, and was not intended to, criticise the accuracy of the Zurich figures, as I quite appreciate that they were carefully compiled results; but I do not think that in this country heaters of the size installed in Zurich would be suitable, or that the consumption would be as low as the figures obtained.

The figures of the water consumption for coal-fired boilers are not intended as a comparison with the Zurich figures, and, as I stated in my letter, these figures are given to show or to indicate the quantities of water used where water is heated by the ordinary kitchen range.

As Mr. Sims states, owing to the thermal inefficiency of coal-fired boilers, habits have been formed by the users, and, as coal is cheap in this country, they expect to get plenty of hot water and are careless in its use. Once habits have been formed, it is very difficult to have them changed, and, if thermal storage tanks of a small capacity are installed in place of domestic boilers, I am afraid people who are accustomed to having plenty of hot water will condemn the system right away, and I think, therefore, it is important that before thermal storage off-peak water heaters are installed these facts should be taken carefully into consideration.

I am not aware of any supply authority which has 90 thermal storage off-peak water heaters connected to its mains, and it is very difficult to get figures in this country so as to compare them with the Zurich figures. As I think there must be a large number of this type of heater fitted throughout the country, the only method of getting reliable figures is to get a technical paper to get these people to send particulars of their sizes of tank installed and consumptions for periods of not less than 12 months. These figures could then be tabulated, and from them a fair idea could be obtained as to the consumption for tanks of this description installed in this country. It was with this idea that I gave particulars of a few tanks of which I have records, and I would state that all these tanks are fitted in houses whose owners are connected with the electrical industry.

The records were taken over a period of 12 months, and are as carefully compiled as the Zurich ones. One of the tanks is placed in the bath-room, and the other tanks are placed in the kitchens with the bath-rooms next door or immediately above.

If Mr. Sims would refer to my letter again, he would see that the 90- and 100-gallon tanks are not installed in houses of 5 and 6 rooms, but in houses of 8 rooms and kitchen. I do not think it is necessary to fit tanks of this size in houses of 5 rooms and kitchen. The reason why these thanks are of such a capacity is that this is the size that is necessary to meet the requirements of the household. The usual size of tank installed in a small house heated by a coal-fired domestic boiler is 20-22 gallons, and, if this tank is to be replaced by a thermal storage off-peak water heater, I think that the size required would be twice this capacity, namely, about 40 gallons.

The basis of my calculations for the water consumption figures in Table I are based on an efficiency of 85 per cent. and an initial temperature of 45 deg. C.

I quite agree that the daily heat losses from a tank used by small families increases the consumption per person, and, even taking into consideration that the kitchen consumption represents 30-40 per cent. of the total, I do not think this explains altogether why the consumption per day per person in large families is so low. I still consider, and shall do so until I am able to get these figures for tanks in this country whose sizes are such as to meet the requirements of the household, that the small capacity of the tank, namely, 22 gallons, installed in a house with 7 to 9 persons has a lot to do with this figure being so low.

There will be nobody more delighted than myself if figures of consumption comparable with the Zurich figures are obtainable in this country, as the use of thermal storage off-peak water heaters would become more popular than they are at present.

Duncan W. Low,
B.Sc., A.R.T.C., A.M.Inst.C.E.

Glasgow, *October 12th*, 1929.

A Problem in Testing.

The following is a working out of the above: Let a = resistance between A and fault; f = resistance of fault; b = resistance between fault and B.

Then, $a + f = 206$, or, $f = 206 - a$; $a + b = 520 - 290 = 230$, or, $b = 230 - a$.

Also, $a + bf/(b+f) = 194$,

therefore, $a + (230-a)(206-a)/(230-a+206-a) = 194$;

multiplying up, etc., we get $-a^2 + 47{,}380 = 84{,}584 - 388a$, or, $a^2 - 388a = -37{,}204$.

Solving this quadratic, we get $a = 194 \pm \sqrt{432} = 194 \pm 20.77$, of which the only possible value of a is $a = 194 - 20.77 = 174.23$; (for 194+20.77, or, 214.77, makes f negative, which is impossible).

As $a + b = 230 = 25$ miles, therefore, distance of fault from A is $25 \times 174.23/230 = 19$ miles.

H. R. Kempe.

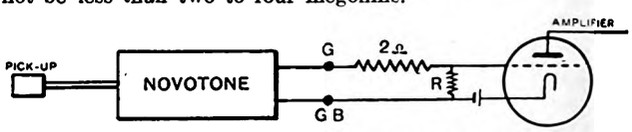
Betchworth, *October 6th*, 1929.

[Replies to the letter of "A.T.S." in the Electrical Review of October 4th, 1929, under this heading have also been received from Messrs. J. B. Berry (Kelty, Fife), J. H. Coghlan (Penzance), T. W. Rowlands (Rugby), W. G. White (Brighton), W. F. Gresswell (Farnborough), O. D. Robinson (Chelmsford), and H. Shackleton (Manchester).—Eds. Elec. Rev.]

"The Novotone."

In your review of the above device as marketed by Gambrell Radio, Ltd., it is not clear that the device is a separate unit, which can be used with any electric gramophone or radio-gramophone combination. It is inserted between the pick-up and the first valve of the amplifier. As demonstrated by Gambrell Radio, Ltd., at the National Radio Exhibition, it was used (as a separate unit) in conjunction with one of their standard radio-gramophone all-mains units.

The "Novotone" augments the voltage from the pick-up appreciably, and it is essential to ensure that the first and succeeding valves of the amplifier are not overloaded. To obviate this the voltage output should be tapped as shown in the diagram: the total resistance across the output terminals must not be less than two to four megohms.



R can be a fixed or variable resistance of any suitable magnitude, say 1 or 2 megohms; the usual grid-leak type of resistance is convenient and has negligible self-capacity.

So far as talking or synchronised kinematograph films are concerned, the "Novotone" will in general require modification to meet the special and varied conditions. In this case it is advisable to be able to alter the degree of correction in the lower and upper registers; also it may be desirable that the correction unit should be connected in the anode circuit of a valve, *e.g.*, talking films. With moving-coil loud-speakers having resonances below 100 cycles (due to a tight surround at the edge of the diaphragm), the human voice will sound "boomy" unless a corresponding allowance is made in the compensator. The "Novotone" gives accurate compensation for gramophone records when the width of the groove is constant below 250 cycles.

N. W. McLachlan.

London, *October 7th*, 1929.

Correction of Balance by Induction Motors.

While reading a book on induction motors I came across a statement which interested me. It referred to the peculiar property of an induction motor in correcting, or attempting to correct, any unbalance in the supply circuit to which it is connected. The unbalanced condition referred to is in cases in which the "open delta" or "V-connection" is used for obtaining a 3-phase supply, under which conditions it may happen that the angle of the V is not quite 120 deg., due, I suppose, to uneven loading of the system. The motor under these conditions tries to pull the phase angle back to normal, but, unless of large size, may become overheated and burn out. What I should like to know is how the motor sets up this correcting influence, and which part of the machine, *i.e.*, stator or rotor, becomes overheated? Granted that the open delta connection is seldom used in practice, and only then for transformers, one might come across a case in which it is in use, if only as a temporary arrangement. Also if trouble from the above cause is suspected, it might be desirable to test the supply circuit to find if the phase angles are equal, and I am not clear how this could be done. Perhaps some of your readers can give an explanation of the above.

Student.

Manchester, *October 6th*, 1929.

Electric Heating.

Much trouble was experienced some time ago in heating an office by electric fires, owing to the fact that cold air from an open window poured down on the occupants of the office, causing coughs and colds. The same trouble also happened when the office was heated with a coal fire. The room was a small one, and at first it seemed impossible to get a satisfactory supply of fresh air without draught. Ultimately a tubular heater was fixed at the bottom of the window, which causes a flow of warm air up the window. This warm air mixes with the cold air coming through the open window and has entirely overcome the difficulty of getting satisfactory ventilation.

At the present time the office is heated by a reflector radiator, and with the tube at the window the effect is very agreeable.

The combination of tubular air heaters at the windows with reflector heaters in the room appears to provide quite a useful method of heating for domestic purposes. Perhaps some other engineers will give their experience.

C. Turnbull.

North Shields, *October 7th*, 1929.

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Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

The British Industries Fair.

At a recent meeting of the Advisory Committee of the Electrical Section of the British Industries Fair, Birmingham, Mr. T. R. Martin was appointed chairman and Mr. H. H. Berry (Berry's Electric (1928), Ltd.) vice-chairman. Mr. E. J. Jennings (Birmingham Electric Supply Department) consented to continue as honorary secretary on the understanding that the British Electrical Development Association would assist in the work incidental to the organisation of the Electrical Section. E.D.A. is taking a prominent part in the 1930 Fair. An outstanding feature will be an E.D.A. kiosk which will be erected in the centre of the Section. The Association will also issue a more complete guide to the Electrical Section, as well as a railway and road service time-table for the convenience of visitors. The question of a distinctive colour scheme for the Electrical Section is being actively pursued, and it is hoped to secure the co-operation of exhibitors in the matter. About 95 per cent. of the electrical exhibitors at this year's Fair have again booked space and a number of new exhibitors are taking stands. The work of the Advisory Committee between now and February will be in the hands of a small executive committee consisting of Messrs. T. R. Martin, H. H. Berry, Dr. A. H. Railing, Lt.-Col. W. A. Vignoles, D.S.O., and Mr. Jennings.

Registered Electrical Contractors.

Applications for registration from the following were accepted by the Executive Committee of the National Register of Electrical Installation Contractors at its last meeting:—

Ryder, C. B., & Co., Ltd., Heathfield, Sussex.
Heptonstall & Connell, Harrogate.
Trojan Electrical Co., Manchester.
Hall, T. J., Cheam, Surrey.
Dunn, W. B., Bedlington, Northumberland.
House, A. W., York.
Brewer & Phillips, Plymouth.

At the same meeting three applications were declined.

The South American Mission.

As we recently quoted the rather adverse comments of the *Review of the River Plate* upon the British Economic Mission to Argentina and Brazil, it gives us pleasure to reproduce a passage from a later issue of our contemporary, in which the assiduity of the Mission is commended. It was written during the Mission's stay in Buenos Aires:—

"Every member of the Mission, from Lord D'Abernon to whoever may be present in his absence, is entirely accessible, and the British Economic Mission has given the most convincing proof of its energy, diligence and good faith by inviting and taking the most careful record of every item of information or criticism available or offered to them. We repeat that their accessibility to any member of the British commercial community, or, for that matter, to any person interested in Anglo-Argentine trade wishing to put forward a particular point of view on some practical aspect of the general problem of trade recovery, is absolute. The co-operation of all who are willing and qualified to inform, criticise, make suggestions or give advice is, we understand, earnestly invited, and when it is considered that the findings of the Mission will have the backing of all the data which British merchants in Argentina are able to mobilise, and that the findings and the data will be put before those who are supposed to be interested on the other side, it is little to say that no merchant having a grievance to ventilate, or a point of view to express, will have the slightest right to grouse at any supposed shortcomings in the Mission's achievements if he fails to take the trouble, during the term of the Mission's sojourn in Buenos Aires, to give to those who are more than willing to listen and heed a clear exposition of his grievance and frank expression to his opinions."

British Plant for Argentina.

It was announced last week that the first contract for the equipment of the Buenos Aires Central Railroad and Terminal Company's new underground railway, which is being built in Buenos Aires, has been awarded to a British concern, the Metropolitan-Cammell Carriage, Wagon and Finance Co., Ltd. The order, which is for the construction of 56 motor-coaches costing about £250,000, was secured in the face of keen competition from American and German manufacturers. Delivery of the final cars has been arranged for the end of August, 1930. The electrical equipment of the coaches has been sublet by the Metropolitan-Cammell Company to the General Electric Co., Ltd. At the time when part of the funds for constructing the new underground was raised in Great Britain assurances were given by the company that on tenders for equipment British manufacturers would be given preference if bids were equal. This £250,000 contract is the first result of these assurances.

Unemployment.

There was an increase of 18,960 in the number of unemployed persons during the week ended September 30th. At that date the total was 1,181,900, as compared with 1,162,940 on September 23rd, and 1,336,379 on October 1st, 1928. During September the average number of persons on the register of Employment Exchanges in Great Britain was 1,158,855, as compared with 1,162,051 in the previous month, and 1,303,386 in September, 1928. On September 23rd there were approximately 10,278,000 insured persons aged 16-64 in employment in Great Britain. This was 2,300 more than a month before, and 269,800 more than a year before.

Our Foreign Electrical Trade.

The following were the values of imports and exports of electrical goods and machinery during September:—

	Sept., 1929.	Inc. or dec. as compared with Sept., 1928.	Nine months, 1929, Inc. or dec.
Imports.	£	£	£
Electrical goods and apparatus	645,064	+ 263,395	+ 1,012,886
Machinery ... ... (including electrical machinery)	1,460,309	+ 229,200	+ 1,666,258
	137,867	+ 40,218	+ 64,094
Exports.			
Electrical goods and apparatus	897,992	− 181,562	+ 650,121
Machinery ... ... (including electrical machinery)	3,768,413	+ 80,204	− 127,878
	432,548	+ 33,524	− 283,389
Re-exports.			
Electrical goods and apparatus	17,634	+ 2,817	+ 32,039
Machinery ... ... (including electrical machinery)	122,388	+ 4,171	− 15,039
	9,153	− 1,925	− 19,187

The Australian Secondary Battery Market.

An American Consular official at Melbourne states that the United States is the principal exporter of storage batteries to Australia, Great Britain being second. About six firms manufacture storage batteries on a large scale in Australia, of which two are American manufacturers who have started factories. These local manufacturers supply about 70 per cent. of the market for replacement batteries, and in some instances the batteries for imported American cars. The cheaper and more popular British cars have storage batteries specially designed for them. Many cheap storage batteries are assembled in Sydney and in Melbourne also. There is a strong feeling in favour of Australian goods; next comes a preference for British products. In spite of the high price of American batteries, however, they are in excellent demand. Locally-made batteries are guaranteed for 15 months unconditionally, whereas American batteries are sold with the standard American 90-day guarantee. Firms representing American storage batteries find that they must do more than this to meet competition from local products. It is stated that the battery business has been injured by the claims of many unprincipled firms who make all kinds of guarantees for their products.

American Refrigerator Exports.

The exports of refrigerating equipment from the United States rose in value from $6,686,593 in 1927 to $8,712,058 last year. The increase was due to a large rise in exports of refrigerators up to 1-ton capacity, particularly small electric models. The United Kingdom accounted for $1,242,307 of the 1927 exports, but in the following year its share dropped to $388,045. At the same time, Canada's share rose from $835,478 to $2,547,643, and Australia's from $679,624 to $746,831.

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Large Engineering Merger.

It was announced last week that a provisional agreement for the merging of their interests had been arranged between Dorman, Long & Co., Ltd., and Bolckow, Vaughan & Co., Ltd. The merger will take the form of the acquisition of Bolckow, Vaughan & Co.'s assets by Dorman, Long, and the name of the latter company will be retained. The new company will have a share capital of £11,248,146 and debenture stock of £5,855,773.

The Swedish Electrical Industry.

The *Swedish Economic Review* in a survey of conditions in Swedish industry during the second quarter of the current year says that the electro-mechanical branch after a period of depression recorded increasing production. The exports of electrical machines during the first seven months of the year were valued at 18,283,000 kr. (£1,000,000 approx.) as compared with 25,181,000 kr. (£1,388,000) in January-July, 1927. There was an increase in exports of telephone and telegraph apparatus, from 7,177,000 kr. (£395,000) to 7,474,000 kr. (£412,000).

Danish Electrical Imports.

Figures recently issued show that the imports of electrical machinery into Denmark during last year attained a value of £1,177,850 as compared with £1,140,800 in 1927. A large part of the imports (28.5 per cent.) consisted of radio material, followed by dynamos and motors 14.2 per cent, electric fans 10.8 per cent. and incandescent lamps 10.3 per cent. Germany is credited with no less than 51.6 per cent. of the imports, Sweden with 11.9 per cent., Holland with 10.8 per cent., the United States with 8.5 per cent., and Great Britain with only 6.9 per cent.

Electrical Imports of Jugo-Slavia.

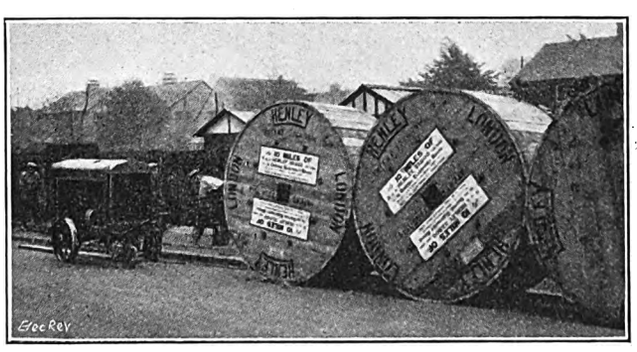
According to figures recently published in Germany the imports of electrical machinery and apparatus into Jugo-Slavia attained a value during last year of £592,300, as compared with £501,350 in 1927. Germany is credited with 35.3 per cent. of the imports, Austria and Hungary with 22 per cent. each, Czecho-Slovakia with 10 per cent., France 2.7 per cent., Switzerland and Holland with 2.3 per cent. each, and Great Britain with 1.1 per cent.

American Radio Condenser Patent Suit.

The Radio Patents Corporation, of New York, informs us that the Dubilier Condenser Corporation has filed a suit in the American Courts against the Aerovox Manufacturing Corporation for the alleged infringement of a Dubilier condenser patent. The Aerovox Corporation is said to have supplied infringing paper condensers to the Radio-Victor Corporation and other radio set manufacturers. The validity of the patent, it is said, is acknowledged by the payment of royalties for manufacturing licences by a number of important concerns, including the Dubilier Condenser Co., Ltd., England, the German A.E.G. and Telefunken concerns, and a subsidiary of the French Thomson-Houston Co. and the Marconi Co. The Dubilier Condenser Corporation recently won an action against the Radio Corporation under several broad patents affecting radio, "talkies," and public address systems.

Cable Drum Publicity.

As an alternative to beating the big drum Messrs. Henley's idea of using it as a poster hoarding is certainly commendable. Our illustration shows two and a half of eighty drums of 33,000-V cable which the company is laying for the Central Electricity Board in the Croydon area. On each of these was



An Effective "Henley" Advertisement.

affixed a poster bearing the following announcement:—"Part of 10 miles of Henley 33,000-Volt Cable for the Central Electricity Board. Manufactured by W. T. Henley's Telegraph Works Co., Ltd., makers of the famous Henley Wiring System."

The Brighton Electrical Exhibition.

An electrical exhibition, organised by the Corporation Electricity Department and the E.D.A., was formally opened by the Mayor (Alderman H. J. Galliers) on October 10th, at the Dome and Corn Exchange, Brighton. In performing the opening ceremony, the Mayor explained the purpose of the exhibition. From the point of view of industrial power, practically the whole of the business possible had been secured, but there was scope for development in the domestic field. He referred to the proposal of the borough electrical engineer, Mr. J. Christie, to form a local branch of the Electrical Association for Women, and urged the ladies to become members. We hope to review the exhibition in our next issue.

A "Mazda" Fancy Dress.

The accompanying picture shows Miss Mellor, of Bolton,

A "Mazda" Fancy Dress.

wearing a fancy dress of her own design. It advertises "Mazda Pearl" lamps very effectively.

Irish Free State Electrical Imports.

The imports of electrical goods, excluding machinery, into the Irish Free State during August last amounted to £39,941, bringing up the total for the first eight months of the year to £387,197 as compared with £285,921 in the corresponding period of 1928.

The E.C.A. to Help the E.T.B.I.

The London Branch of the Electrical Contractors' Association is organising a function in aid of the Electrical Trades Benevolent Institution which should lead to a substantial contribution to the Institution's funds. It takes the form of a ball and cabaret at the Portman Rooms, Baker Street, W.1, on November 7th. The notification which we have received from Mr. C. H. Flower, chairman of the London branch, indicates that a happy evening will result. The attractions mentioned are: "A first class dance; front rank cabaret turns; 'lucky number' tickets for exciting prizes; refreshments provided. Cheers and laughter all the time." Tickets for this function (15s. each) can be obtained from the E.C.A. headquarters, 15, Savoy Street, W.C.2.

Bankruptcy Proceedings.

G. E. Hine, trading as the Wireless Maintenance Service, 17, The Promenade, Church End, Finchley, & 28, Mayfield Avenue, Finchley.—The public examination of this debtor was held recently, at the Court House, Barnet, when a statement of affairs was lodged showing liabilities of £764, against estimated assets of £48, leaving a deficiency of £716. The debtor commenced trading in 1922, with £40 savings and £100 borrowed from a relative. In April of last year he removed from Cricklewood to Finchley, expending £150 on a shop front, of which £75 was allowed by the landlords, and about £100 in fitting up the shop. In order to meet these payments, he obtained loans from his wife and friends. Owing to local competition his turnover was greatly reduced, and he discontinued trading in July, 1929. He is now in employment. The examination was closed.

E. G. M. Page, dealer in wireless sets and accessories, 46, Bohemia Road, St. Leonards-on-Sea.—First meeting to-day (Friday) at the Official Receiver's offices, 12a, Marlborough Place, Brighton. Public examination, November 11th, at the Town Hall, Hastings.

J. Hobson, electrical engineer, 1a, Thorncliffe Grove, Whitworth Park, Manchester.—First meeting held October 15th at the Official Receiver's offices, Byrom Street, Manchester.

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Public examination, November 8th, at the Court House, Manchester.

A. K. E. Strathdee (Emsco Radio), electrical engineer, 923, Romford Road, Manor Park.—Application for discharge to be heard October 29th at Carey Street, W.C.

F. E. Care (F. E. Care & Son), electrical goods dealer, &c., 40, Paradise Street, West Bromwich.—Last day for proofs for dividend, October 24th. Trustee, Mr. C. Hoult, Official Receiver, 191, Corporation Street, Birmingham.

W. J. Philles, electrical engineer, 87, Overton Road, Leicester.—First meeting to-day (Friday), at the Official Receiver's office, 1, Berridge Street, Leicester; public examination, November 1st, at the Castle, Leicester.

H. E. Davy, electrical engineer, Gloucester Place, Monument Street, Peterborough.—First meeting, October 18th; public examination, October 25th, both at the Law Courts, Peterborough.

M. Kelly, radio apparatus dealer, 12, Jackson's Row, Manchester.—Application for discharge to be heard on November 4th at the Court House, Manchester.

N. H. Wood, electrical engineer, 32, Highbury Avenue, Thornton Heath.—Application for discharge adjourned generally with liberty to restore.

L. H. Lawrence (H. F. Lawrence), electrical engineer, 43, Canterbury Road, Margate.—Last day for proofs for dividend, October 26th. Trustee: Mr. C. S. Scarlett, 5, Cecil Square, Margate.

J. Littler, electrical and radio engineer, 9, Hoghton Street, Southport.—First and final dividend of 2s. 6d. in the £, payable October 25th at the office of the Trustee, Mr. A. T. Eaves, 47, Mosley Street, Manchester.

Company Liquidations.

Power Development Co., Ltd.—As we have already reported, this company is in voluntary liquidation, its interests in electricity supply companies having been transferred to the British Power and Light Corporation (1929), Ltd. A meeting of creditors has been called for October 22nd at the offices of the liquidator (Mr. A. D. Wykes), 67, Watling Street, E.C.4. The meeting is purely formal, as all creditors have been, or will be, paid in full.

Manchester Private Telephone and Electric Lighting Co., Ltd.—A petition for the winding up of this company has been presented to the County Court of Lancashire by the National Bank, Ltd., and will be heard in Manchester on October 28th.

Mawlite Electric Lamp Co., Ltd.—A meeting of creditors was called for October 14th at 28, Belgrave Road, S.W.1. Particulars of claims by October 31st to the liquidator, Mr. S. E. Eastbury.

Erith Electrical Contractors, Ltd.—A meeting of members is called for November 14th at Albion House, 87-89, Aldgate High Street, E.C.3, to hear an account of the winding up from the liquidator, Mr. L. G. Darling.

Private Arrangements.

S. A. Hunter, trading as the "Electro-Generator Co.," 5, Uxbridge Road, W.—A meeting of creditors was held recently at the offices of Messrs. Cohen, Dunn, Page & Moore, solicitors, Audrey House, Ely Place, E.C. A statement of affairs was submitted, which showed ranking liabilities of £674 and net assets of £254, leaving a deficiency of £420. The debtor's accountant reported that his client had been in business for more than 20 years, and had never previously been in difficulties. During the last year or two the debtor had suffered through lack of capital, and a short time ago writs were issued against him by two creditors for substantial amounts. The debtor then entered into arrangements to sell his stock, and he was able to dispose of it to advantage, realising more than £900. That money was utilised in discharging the claims of pressing creditors and paying off an overdraft at the bank. He had thought that the assets would realise more than sufficient to meet the whole of his liabilities in full. The debtor made an offer of a composition of 6s. 8d. in the £, which was subsequently increased to 10s. in the £. A resolution was passed agreeing to accept the latter offer.

Dissolutions of Partnership.

Woodhouse & Mellanby Electrical Engineers, Landbeach, Cambridge.—Mr. P. M. Woodhouse and Mr. J. Mellanby have dissolved partnership. Mr. Mellanby will attend to debts and continue the business.

Elektra Supplies, importers and distributors of wireless and electrical components, 43, Grafton Street, Tottenham Court Road, W.—Mr. J. Langdorf and Mr. J. G. Ivory have dissolved partnership. Debts will be attended to by both partners.

Deed of Assignment.

Mr. W. E. Atherton (Atherton & Hall), radio engineer, Claremont Works, General Street, Blackpool.—Particulars of claims by November 12th to the Trustee, Mr. I. G. Aspinall, 7, Birley Street, Blackpool.

Trade Announcements.

The General Electric Co., Ltd., opened a new branch at Magnet House, 3, Campbell Street, Leicester, on October 14th. Mr. W. J. Hodgkins, of the Birmingham branch, has been appointed manager. The telephone number is Central 58778 and the telegraphic address "Electricity."

Frigidaire, Ltd., has opened new showrooms at Transport House, 210, Broad Street, Birmingham.

The Athol Electrical Co., Cheetham Hill, Manchester, is commencing the retail sale of electrical and radio supplies and contracting work. All correspondence on the matter should be addressed to Mr. J. R. Hoult, 9, Peru Street, Higher Broughton, Manchester.

The Underfeed Stoker Co., Ltd., announces that it has secured the sole manufacturing rights for "Vibro" conveyors under the Schenck-Heymann system, the conveyors being manufactured entirely at the company's works at Derby.

Messrs. Harry Jones & Co., electro-platers, have removed to new and larger premises at 32, Goodge Street, W.1, where they have installed additional plant.

The Wardle Engineering Co., Ltd., announces that Mr. W. Rintoul has relinquished his agency for Yorkshire, having accepted a whole-time appointment elsewhere. In future this territory will be worked from the head office, Old Trafford, Manchester.

British Insulated Cables, Ltd., has entered into an agreement with the Rockbestos Products Corporation, of New Haven, Conn., U.S.A., whereby it takes over the sale and manufacture of all asbestos-covered cable, wire, and other similar products made under the patented processes of the Corporation, and marketed under the trade mark "Rockbestos." The B.I.C. is installing new plant, and will shortly be in a position to manufacture here in British sizes.

On October 7th the Liverpool Electric Cable Co., Ltd., opened a new warehouse at 38, Western Road, Leicester (telephone No.: 60845), where adequate stocks of cables and wires are being maintained.

Mr. Evan Jones has commenced business as an electrical contractor at 39a, Queen Street, Aberystwyth.

Mr. Fred Reynolds, late sales manager and traveller to Messrs. F. Dawson, Leeds, has commenced business on his own account at 17, York Place, Leeds, as wholesale electrical factor and manufacturers' agent.

Coventry Electrical Appliances, Ltd., states that owing to the increase in the demand for its products it is taking additional premises, a part of the Coventry Ordnance Works.

New Catalogues and Lists.

The A.E.G. Electric Co., Ltd., 131, Victoria Street, S.W.1.—October stock list of electrical machinery, instruments, appliances, &c.

Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, S.W.1.—Monthly stock list for October; illustrated.

Brook Motors, Ltd., Empress Works, Huddersfield.—Three publications drawing attention to the company's motors.

Cambridge Instrument Co., Ltd., 45, Grosvenor Place, S.W.1.—List No. 144 describing apparatus for the analysis of gases, and covering some applications. Illustrated.

Messrs Siemens Bros. & Co., Ltd., Woolwich, S.E.18.—A number of publications, illustrated and priced, dealing with temperature measuring instruments.

Berry's Electric (1928), Ltd., 85-86, Newman Street, W.1.—A well-produced loose-leaf catalogue of the many designs of "Magicoal" fires. The publication is fully illustrated (some in colour), and prices are included.

Riley Stoker Co., Ltd., 9, Bridge Street, S.W.1.—A brochure describing the company's stoker and pulverised fuel equipment, with illustrations.

Messrs. L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, W.C.2.—A card drawing attention to the "Frink Silverlite" system of illumination.

Messrs. Wolf & Morgan, Ltd., 66, Victoria Street, S.W.1.—A price list of Wagner and W.M. a.c. and d.c. motors.

The Wholesale Electric Lamp Co., Ltd., 37, Vauxhall Bridge Road, S.W.1.—An illustrated and priced pamphlet of the company's fires, kettles, irons, &c.

Igranic Electric Co., Ltd., 149, Queen Victoria Street, E.C.4.—An illustrated leaflet describing the company's screened-grid valve short-wave receiver; also a number of publications dealing with "Igranic" radio accessories.

British Thomson-Houston Co., Ltd., Crown House, Aldwych, W.C.—A card giving prices of "Mazda" 150-V lamps, and a table of the approximate number of hours' burning for 1d. for lamps of from 15 to 500 watts.

Messrs. Falk, Stadelmann & Co., Ltd., 83-93, Farringdon Road, E.C.1.—Catalogue No. C21 containing fully-illustrated particulars and prices of "Efesca" radio receiving sets, components and accessories.

Messrs. Rowland Hill & Sons, Ltd., King Street, Coventry.—A booklet describing the "Alpax (R.H.)" aluminium-silicon alloy for sand castings.

Elm Works, Ltd., Summerstown, Tooting, S.W.17.—A loose-leaf catalogue of lamp casings, reflectors, and accessories for electric lighting. Illustrated and priced.

Messrs. De Brunner & Lang-Sims, 3 & 4, King Street, Covent Garden, W.C.2.—A number of calendar-blotters for October advertising "Margo" appliances.

Messrs. T. B. Morley & Co., Ltd., Jameson Street, Hull.—A well produced brochure, illustrated in colour, of "Morco" illuminating glassware. Priced.

Wardle Engineering Co., Ltd., Elsinore Road, Old Trafford, Manchester.—An illustrated pamphlet drawing attention to "Prismat" bulkhead fittings.

Messrs. Edward Bennis & Co., Ltd., 28, Victoria Street, S.W.1.—Two catalogues dealing with the new "Bennis" carrier bar chain grate and pulverised fuel system.

Messrs. E. Shipton & Co., Ltd., Caxton House, Tothill Street, Westminster, S.W.1.—Two leaflets dealing with the Shipton staff signalling systems.

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Recent Contracts.

The Westinghouse Brake & Saxby Signal Co., Ltd., has received an order for the supply of power signal material for the re-signalling, on the electro-pneumatic principle, of the Bombay Central Station of the Bombay, Baroda & Central India Railway. The material includes a 119-lever power locking frame; an illuminated diagram, strip light type; 35 a.c. track circuits complete with track transformers, relays, &c.; 34 electro-pneumatic facing point layouts with point indication relays, compressors, switch-gear, &c.; 16 three-aspect colour light signals, and 21 two-aspect globe type shunt signals; 2 7-way route indicators, and other apparatus. The equipment will be installed by the Railway Company Signal Department.

Following on the rapid increase in telephone calls between this country and the Continent, Messrs. Siemens Bros. & Co., Ltd., have received an important contract to make and lay a new Anglo-Belgian cable. The estimated cost will considerably exceed £100,000. The cable, over 75 miles in length, will run from Canterbury to La Panne, in Belgium. It will be a duplicate of the present land and submarine line laid by Messrs. Siemens on the same route in 1926. Work will be begun almost at once, giving employment to a large number of men throughout the winter months.

Local Exhibitions.

Overton.—An exhibition arranged by the Basingstoke Electricity Department (engineer: Mr. F. Swarbrick) was held on October 8th and 9th. At the opening ceremony, which was performed by the Mayor of Basingstoke, Major Rich addressed the assembly on electrical development and the use of electricity for domestic and agricultural purposes. There was a special display of agricultural implements shown under working conditions, which aroused much interest among the farming community. A number of local firms supplied apparatus, and in addition Electrolux, Ltd., displayed vacuum cleaners, and Domestic Electrification, Ltd., provided a complete range of cookers. Special cooking demonstrations were given by Miss V. Swarbrick.

Tunbridge Wells.—The annual Empire Exhibition was opened at the Calverley Grounds Pavilion on October 12th. The electrical section of the display is well-arranged and very representative. Outside the exhibition hall there is a furnished bungalow, which has been electrically equipped by the local branch of the Electrical Contractors' Association. Messrs. Strange & Sons Electrical Engineering Co., Ltd., have a large and varied display which includes "Magicoal" fires, "Marco" refrigerators, other domestic appliances and radio apparatus. The Advance Electrical Co. exhibits the "Kelvinator" refrigerator and "Hoover" suction cleaner in addition to lighting fittings and other appliances. Messrs. E. Powell, Ltd., demonstrate the advantages of Ericsson's intercommunication telephones and also show heating and labour-saving devices. On the stand of the Tunbridge Wells Electricity Department, daily demonstrations of electric cooking are given, while attention is drawn to the Department's hiring scheme which covers cookers, water-heating apparatus, &c. A special display of electrical wiring is staged by Callender's Cable & Construction Co., Ltd., and the names of local contractors using the company's system are given prominence. The sound-amplification system in the hall was installed by Mr. H. Featherstone who has a stand bearing examples of "Heatrae," "Magnet," "Belling" and "Creda" fires, "Vac-Tric" cleaners, radio apparatus, &c. Wireless equipment is also exhibited by Messrs H. A. Stonham & Co., Ltd., who also show "Electro-Vapour" radiators. The exhibition closes to-morrow (Saturday).

Book Notices.

"The Electrical Contractors' Year Book, 1929-30" (pp. 499). London: The Electrical Contractors' Association, Inc. Price 5s.—For the past few years this useful publication has been "swelling wisibly"; the new edition has nearly forty more pages than the last. As usual the frontispiece is a portrait of the president. This year he is Mr. H. Willoughby-Ellis, who contributes an article to this issue of the Electrical Review. A brief report of the successful fourth annual Conference at Bournemouth is included, together with Mr. Walton's presidential address and annual report. A useful addition is a set of conditions of tender and contract for electrical work, together with a model memorandum of agreement for carrying out work on a "cost plus percentage" basis. The other features of the Year Book are retained, and have been brought up to date. The section dealing with the National Register now includes a statement of the "nine deadly sins," the commission of which will render a contractor liable to removal from the Register.

"L'Annuaire 1929 de la Société Francaise des Electriciens." From the Société Francaise des Electriciens, of Paris (12-14, Rue de Stael) we have received a copy of its 1929 Year Book, which gives a list of the members of the committee of the Association and of its various sub-committees, together with a full list of the names and addresses of the members. Other contents of the annual handbook comprise particulars of the Laboratoire Central d'Electricité and the Ecole Supérieure d'Electricité and their work.

"The Calculation of the Articulation of a Telephone Circuit from the Circuit Constants," by J. Collard, A.C.G.I., B.Sc.(Eng.), A.M.I.E.E. Pp. 36; figs. 13. London: International Standard Electric Corporation.—This bulletin deals with the theory and practical application of the method, and includes a comparison of the calculated and measured results; a bibliography is attached.

"The Post Office Electrical Engineers' Journal." Vol. XXII, Part 3. October, 1929. London: "Electrical Review," Ltd. Price 1s. 3d. net.

"The A.B.C. of Television, or seeing by Radio." By R. F. Yates. Pp. viii+210; 78 figs.; 21 illustrations. Chapman and Hall, Ltd. Price 10s. 6d. net.

Research Papers of the U.S.A. Bureau of Standards, No. 90. —A comparison of the formulas for the calculation of the inductance of coils and spirals wound with wire of large cross section. Price 10 cents.

Social Events.

The healthy and invigorating hills of Derbyshire were visited by the employés of the Midland Dynamo Co., Ltd., Leicester, on the occasion of their annual outing. The party, numbering about 75, was conveyed in two saloon 'buses, arriving at Dovedale about noon. The afternoon was spent in visiting beauty spots in the vicinity of the "Peveril of the Peak Hotel," where tea was served. The sports which were held immediately after proved very popular, and produced several amusing incidents. The weather was good.

Dramatics at Metropolitan-Vickers.—A very pleasing performance of the modern farce, "The Whole Town's Talking," by John Emerson and Anita Loos (the authoress of "Gentlemen Prefer Blondes") was given by the M.V. Dramatic and Operatic Society in the Club Theatre on October 9th. The acting was first-rate, and the audience very appreciative. The performance was repeated on the three succeeding evenings with equal success.

Prices of Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.	Price Oct. 15th.	Fortnight's inc. or dec.
a	Acid, Oxalic ... ... per lb.	5¾d.	...
a	Ammoniac, Sal ... ... per ton	£60	...
a	Ammonia, Muriate (large crystal) ,,	£52	...
a	Bisulphide of Carbon ... ... ,,	...	...
a	Borax ... ... ,,	£25	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... ... per lb.	3½d. to 4d.	...
a	,, Perchlorate ... ... ,,	5½d.	...
a	Shellac ... ... per cwt.	£13 10s.	...
a	Sulphur, Commercial ... ... ,,	£11	...
a	,, Roll ... ... ,,	£11	...
a	Soda, Chlorate ... ... per lb.	3d.	...
a	,, Crystals ... ... per ton	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	3⅝d.	...
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton	£95 to £100	...
b	,, Wire ... ... per lb.	1/1 to 1/9	...
b	,, Sheet ... ... ,,	1/1 to 2/9	...
p	Babbitts Metal and Anti-friction Metals—		
	Grade I ... ... per ton net	£175	£12 dec.
	Grade II... ... ... ,, ,,	£124	£7 dec.
	Grade III ... ... ,,	£69	£3 dec.
c	Brass (rolled metal 2" to 12" basis) per lb.	10½d.	...
c	,, Tubes (solid drawn) ... ,,	1/0⅞ to 1/1	...
c	,, Wire, basis ... ... ,,	11⅛d.	...
c	Copper Tubes (solid drawn) ... ,,	1/3	...
g	,, Bars (best selected) ... per ton	£110	...
g	,, Sheet ... ... ,,	£110	...
g	,, Rod ... ... ,,	£110	...
d	,, (Electrolytic) Bars ... ,,	£84 10s.	5/- dec.
d	,, ,, Sheets ... ,,	£143 10s.	...
d	,, ,, Wire Rods ,,	£94 10s.	5/- dec.
d	,, ,, H.C. Wire per lb.	11⅞d.	⅛d. dec.
f	Ebonite Rod... ... ... ,,	2/3 to 2/6	...
f	,, Sheet ... ... ,,	2/3 to 2/6	...
n	German Silver Wire ... ... ,,	2/2	...
h	Gutta-percha, fine ... ... ,,	nom.	...
h	India-rubber, Para fine ... ... ,,	10d.	...
i	Iron, Pig (Cleveland No. 8.) ... per ton	72/6	...
l	,, Wire, galv. No. 8. P.O. qual. ,,	£20	...
g	Lead, English pig ... ... ,,	£24 15s.	5/- dec.
g	Mercury ... ... per bot.	£22 10s. to £22 15s.	...
e	Mica (in original cases) small ... per lb.	3d. to 3/-	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,,	10/- to 20/- & up	...
p	Phosphor Bronze, plane castings ,,	1/3½	...
p	,, ,, drawn bars & rods ,,	1/5	...
p	,, ,, rolled strip & sheet ,,	1/3⅝	...
p	,, ,, wire... ... ... ,,	1/6½	...
o	Platinum ... ... per oz.	£13 17s. 6d.	...
d	Silicium Bronze Wire ... ... per lb.	1/2⅛	...
r	Steel, Magnet, in bars ... ... ,,	7½d.	...
g	Tin, Block (English) ... ... per ton	£191 5s. to £192 5s.	£8 10s. to £9 5s. dec.
n	,, Wire, Nos. 1 to 16 ... ... per lb.	3/8	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Messrs. James Forster & Co., reporting on October 12th, stated that a slightly better demand for lead from consumers last week has given a firmer tone to the market, and prices have advanced. The firmness has also been assisted by a temporary shortage of arrivals. The future is obscure, and depends on the tactics employed by the Producers' Association. Under present conditions there seems little justification for any higher prices than those ruling.

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Lighting and Power Notes.

Ayrshire.—Street Lighting.—The District Committee is communicating with the Electricity Board regarding the laying of the underground cable for street lighting at Catrine.

Barnes.—Inquiry.—Colonel T. C. Ekin, for the Electricity Commissioners, will hold an inquiry at the Council House, Mortlake, on Wednesday, November 13th, into the application of the Urban District Council for consent to the extension of its generating station.

Barrow.—Assisted Wiring Scheme.—The Town Council has decided that an assisted wiring scheme shall be adopted, and is to apply for sanction to a loan of £5,000 in connection with it.

Bournemouth.—Extension of Supply Area.—The Bournemouth and Poole Electricity Supply Co., Ltd., has applied to the Electricity Commissioners for an amendment of the Special Order made on March 16th, 1928, so as to sanction the transfer to the company of the powers granted to the Wareham Electric Supply Co., Ltd., in the Wareham Special Order, 1922.

Brighton.—New Plant Installed.—A new 15,625-kW turbo-alternator set supplied by Messrs. Richardsons, Westgarth and Co., Ltd., of West Hartlepool, was started up by the Mayoress of Brighton at the Corporation's Southwick power station last Saturday.

Buxton.—Loan Sanctioned.—The Corporation Electricity Committee has obtained sanction to a loan of £9,842 for mains and services.

Dorchester.—Two-part Tariff.—The Corporation Electricity Committee has recommended the following two-part tariff for large business premises where the total lighting connection is 15 kW or over:—A standing charge of £10 per kW connected per annum, payable in advance by quarterly instalments (one-third to be paid at the commencement of each of the two winter quarters, and one-sixth at the beginning of each of the two summer quarters), plus 2d. per kWh consumed for any purpose.

East Sussex.—Overhead Lines Decision.—After careful consideration of the report on the inquiry held on September 11th and subsequent days into the application made by the Central Electricity Board for consent to the erection of an overhead transmission line from Brighton to Hastings *via* Eastbourne, the Minister of Transport has decided to give his consent to the erection of the line along the route proposed subject to further consideration being given to the position of the line and its supports to the immediate south-west and south-east of Offham Village, and subject also to the reservation of power to review the situation at any time after the expiration of a period of five years.

Gillingham (Kent).—Wiring Scheme.—The Town Council has come to an arrangement with local electrical contractors for electric wiring and fitting work. The work is to be carried out in rotation, the borough electrical engineer to take his turn in the work. The scheme is to be carried out for three months, when the engineer will report up on it. A sum of £2,000 is to be transferred from the reserve fund for this purpose.

Hastings.—Electricity Supply.—The Corporation Electricity Committee has recommended that a supply of electricity shall be given to Staplecross, Cripps Corner and Ewhurst, at an estimated cost of £7,190.

Hull.—Surface Wiring.—At a recent meeting of the Corporation Electricity Committee, the engineer reported that in order to deal economically and expeditiously with the large number of applications for supply from terrace houses, he was experimenting with a system of surface wiring for the premises, which reduced the cost by approximately one-third as compared with concealed systems. The work was being carried out initially by labour supplied by approved contractors, and when sufficient data was available as to the average cost, he recommended that, if the system was successful, future work of this character should be carried out by approved contractors at scheduled rates. The action of the engineer was approved, and his recommendation adopted.

Loans Sanctioned.—The Committee has received sanction to the borrowing of £100,000 for mains and services, and £50,000 for sub-stations and equipment.

Electricity Extensions.—The electrical engineer has recommended carrying out, under the unemployment scheme, the development of the supply department's distributing network in areas which would otherwise not be proceeded with for some time, at a cost of £120,000. The Committee has obtained consent to supply areas in the urban district of Corringham, the boroughs of Beverley and Hedon, and the rural districts of Beverley, Skirlaugh, Sculcoates, and Partington. The total area covered by this sanction is 120 sq. miles, and preliminaries are already in hand for the carrying of the trunk lines into the areas.

Irish Free State.—Limerick.—The Electricity Supply Board has estimated that the wiring of the Limerick Mental Hospital will cost £2,500. The Managing Committee has decided to light the institution by electricity and to invite tenders for the work.

Liverpool.—Loan Sanctioned.—Sanction has been obtained by the Liverpool Tramways and Electric Power and Lighting Committee to the borrowing of £300,000 for prospective expenditure on mains and services.

Assisted Wiring Scheme.—The Electric Power and Lighting Committee has proposed the adoption of an assisted wiring scheme. The Corporation is to provide installations on payment of a deposit of £2, plus either 2s. per lamp per quarter for 12 quarters, or 1s. 3d. per lamp per quarter for 20 quarters. It is provided that the installation shall consist of not fewer than four and not more than 17 lighting points.

New Mill.—Year's Working.—The accounts of the Urban District Council's electricity undertaking (engineer: Mr. E. Marsden) for the twelve months ended March 31st last record a total revenue of £3,234 and a working expenditure of £1,739, leaving a gross profit of £1,495. The figures for the previous year were:—Income, £3,004; working expenses, £1,731; gross profit, £1,273. After providing for interest on loans and contributions to sinking fund, there was a net surplus of £650, as compared with £584 in the preceding year. The Council obtains the whole of its electricity supply in bulk from the Yorkshire Electric Power Co., and during the year under review purchased 281,755 kWh, as against 251,716 kWh in 1927-28. The electrical energy sold increased from 234,434 to 255,978 kWh, and the total maximum supply demanded from 155 to 172 kVA.

Oldham.—Loan Sanctioned.—The Corporation Electricity Committee has received sanction to the borrowing of £50,000 for mains.

Plymouth.—Loan.—The Corporation Electricity Committee is seeking sanction to the borrowing of £65,000 for mains and services.

Porthcawl.—Street Lighting.—The Urban District Council has decided that the contract for the lighting of the town shall be given to the General Electric Co., Ltd., subject to a provisional agreement being signed and the consent of the Electricity Commissioners being obtained for the transfer of the Order from the Council to the company.

Portsmouth.—Mains Extensions.—The Corporation has applied for sanction to the borrowing of £10,090 for the extension of its h.p. main to Singleton in order to give a bulk supply of electricity to the Midhurst and District Electric Supply Co., Ltd. Sanction has already been received to the borrowing of £8,000 for mains and works in connection with the bulk supply to the Petersfield Electric Light & Power Co., Ltd.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

Dartford.—Shop lighting: from £12 per annum per kW of maximum demand plus 2d. per kWh, to £10 plus 1½d. per kWh, the present minimum of 2 kW being reduced to 1 kW.

Eastbourne.—Shop-window lighting after business hours: from 2d. to 1d. per kWh, with a charge of 5s. per quarter for the time-switch required. The "follow-on" rate for consumers supplied on the old maximum demand rate: from 2¾d. to 2½d. per kWh. Flat rate for heating and cooking reduced to ¾d. per kWh all the year round, instead of for the six summer months only. Water heating by thermal storage cisterns; (*a*) first 250 kWh per quarter, ¾d. per kWh, any additional energy, ½d. per kWh; (*b*) off peak load between 10 p.m. and 6 a.m., 0.3d. per kWh, with a charge of 6s. per quarter for time-switch and meter required.

Liverpool.—Lighting flat rate in Liverpool, Bootle, and Litherland: Up to 3,000 kWh per quarter, from 3¾d. to 3½d. per kWh; 3,001 to 10,000 kWh, from 3½d. to 3d.; over 10,000 kWh, from 2¾d. to 2½d. per kWh. Lighting flat rate in Waterloo-with-Seaforth and Great Crosby: Up to 3,000 kWh per quarter, from 5d. to 4½d. per kWh; 3,001 to 10,000 kWh, from 4½d. to 4d.; over 10,000 kWh, from 4d. to 3½d. per kWh. Prepayment meter charge in Liverpool and Bootle: From 4½d. to 4¼d. per kWh. Prepayment meter charge in Waterloo: From 5¾d. to 5½d. per kWh. Fringe Order prices are to be reduced in the same proportion. Maximum demand charges for power in all areas: From £1 10s. to £1 7s. 6d. per quarter.

Woodbridge.—*Woodbridge and District Electric Light Co., Ltd.*—A reduction of 1d. per kWh for lighting and power.

Scarborough.—Electricity Works Extensions.—A part of the extensions to the Corporation electricity works was put into operation recently by Sir Harry Haward, vice-chairman of the Electricity Committee.

Sunderland.—Change-over Scheme.—The Town Council has adopted electricity schemes for the relief of unemployment, at an estimated cost of £133,704, subject to satisfactory grants being made by the Government departments concerned. The schemes provide for ten new sub-stations and switch-houses (£33,050), e.h.p. feeders (£37,169), h.p. mains (£20,737), and the continuation of the change-over from d.c. to a.c. (£34,049). Apart from these schemes, application has been made for sanction to a loan of £18,086 for three additional sub-stations and for mains extensions.

Worthing.—Loan Sanctioned.—The Town Council has received sanction to a loan of £20,000 for mains and services.

York.—Extension of Supply Area.—The Electricity Commissioners have granted the Order extending the Corporation's area of supply in accordance with its amended application. The maximum charge in the existing and new areas has been fixed at 8d. per kWh.

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Tramway and Railway Notes.

Bristol.—The Tramway Purchase Option.—The special committee appointed by the Corporation to investigate the question of exercising the city's option to purchase the undertaking of the Bristol Tramway & Carriage Co., Ltd., presented its report last week. The committee has recommended that it is not desirable for the city to exercise its option to purchase, but suggests that a valuation be made of the undertaking, including the city omnibus service, with a view to avoiding the costs of long and expensive arbitration at some future date. It is stated that at least £1,000,000 would have to be paid for the undertaking.

Japan.—Railway Electrification.—It is stated that the proposed electrification of the Government railway between Higashi-Kanagawa and Hachioji is to be carried out shortly.

Railless-Cars.—The Yoro Electric Railway has been granted a charter to run a railless-car service between Yoro Station and Yoro Park. The only other railless-car system in Japan is at Osaka.

London.—Tramcar Improvements.—The fifty single-decker tramcars which were withdrawn from service when the Kingsway tunnel was closed are now being converted into double-deckers of the Pullman type, having a carrying capacity of seventy-two passengers. Of the London County Council's 1,750 cars, over 1,000 have already been modernised, and under a scheme of conversion now being carried out a further 450 are to be brought up to date. The remaining 300 cars are to be scrapped and replaced by modern vehicles.

New Tube Railway.—As a result of a conference between the Minister of Transport and representatives of the Underground group and the London County Council it is stated that work will be commenced either next year or in 1931 on a new tube railway extending from Finsbury Park to Enfield. The line, which will be an extension of the existing Piccadilly Railway, will run through Harringay, Wood Green and Palmer's Green.

Underground Railway Escalators. — The escalators installed at the Camden Town Underground Railway station started work on October 7th, and the three lifts were taken out of service. Camden Town is the twenty-ninth station to be equipped with moving stairways. There are now 85 escalators on the Underground electric railway system.

Rotherham.—Railless-Cars.—The Corporation Tramways Committee is to apply to the Unemployment Grants Committee for a grant towards the cost of the proposed substitution of railless-cars on several tramway routes. The committee has authorised the transport manager to proceed with the scheme for the conversion of the Dalton and Silverwood tramway routes, and to obtain tenders for vehicles and equipment. The committee is also to obtain tenders for vehicles and equipment for the conversion of the Kimberworth route.

Southern Railway.—Electrification of Brighton Line.—In an official announcement issued by the Southern Railway, it was stated that under the conditions attaching to the recent remission of passenger duty the Southern Railway guaranteed to undertake an expenditure of 80 per cent. of the capitalised amount (roughly £2,000,000) on improvements. The directors have, therefore, authorised the following electrification schemes, work on which will be begun during the next two or three months:—(i) The main line from London to Brighton (51 miles, of which 14 miles to Purley are already electrified); (ii) the line from Preston Park (on the Brighton main line) to Hove and Worthing, 11 miles; (iii) the line from Redhill (on the Brighton main line) to Guildford, *via* Reigate and Dorking Town (20 miles). When the London to Brighton scheme is completed it will be the longest electrified route in Great Britain, and the first main line to be completely equipped for electric traction. The trains will run on the d.c. third-rail system, which is now the standard throughout the electrified area of the Southern Railway.

Telegraph and Telephone Notes.

International Telephony. — Submarine Cables. — Messrs. Siemens Bros. & Co., Ltd., have received an order to make and lay a duplicate of the Anglo-Belgian land and submarine telephone cable which they manufactured in 1926.

Traffic.—The British Post Office system dealt with 42,768 outgoing and 45,667 incoming international calls in May, 1929, which figures represent increases of 19 and 11.7 per cent., respectively, over the corresponding month last year. In 1928 the "unit" calls totalled 880,000.

Anglo-Italian Service.—Telephone communication is now available from London to the following additional towns in Italy: Trento, Merano, Trieste, Verona, San Remo, Parma, and Florence (Firenze).

Italy.—German Telephone Cables.—We have been asked to amend the note which appeared under the above heading in our September 13th issue (p. 442) in the following terms:—The Siemens & Halske Co., of Berlin, in conjunction with the Italian cable works and the Italian Long-Distance Cable Co. (Sirti), has recently completed the laying of a Pupin (loaded) long-distance cable between Rome and Naples for the Italian Post and Telegraph Authorities. The same firms have also received an order from the Government Department for the laying of a cable, about 262 miles in length, between Poggio, Renatico, and Trieste, with a branch to Austria. The cables for this installation will be supplied by Italian factories, the Pupin and other fittings by the Seimens & Halske Company, while the installation will be carried out by the "Sirti" concern.

Transoceanic Telephony.—Spain-Argentina.—A wireless telephone service between Buenos Aires and Madrid was inaugurated on October 11th-12th.—*Reuter* (Buenos Aires).

The *Daily Telegraph* announces that the inaugural ceremony took place at the Seville Exhibition, when General Primo de Rivera, the Spanish Prime Minister, telephoned messages of congratulation to the Presidents of the Argentine and Uruguay, and spoke to the Spanish Ambassador at Buenos Aires and to the Minister in Montevideo. South America is thus brought into direct touch with telephone subscibers in nearly every country in Europe by means of the land lines to the Spanish transmitting station near Madrid. The receiving and transmitting stations in South America are near Buenos Aires. The system of wireless telephony employed ensures privacy, as the waves are transmitted in such a fashion that they are unintelligible to the ordinary receiving station. Except for the service between Great Britain and the United States, this is the only radio telephone link that is connected to public telephones at both ends, permitting subscibers to speak from their own instruments. The transmitting and receiving stations for this new link were supplied by Standard Telephones and Cables, Ltd., and were manufactured in their works at Woolwich and Hendon, England.

Radio Notes.

London Programmes.—Brookman's Park.—The London regional transmitting station at Brookman's Park will take over the entire service for the London area at 3.30 p.m. on October 21st. The Oxford Street transmitter will then be closed down.

Poland.—Relaying.—In connection with the new scheme recently announced, by means of which alternative programmes on the English model will be made available throughout Poland, it is interesting to learn that the contract obtained by Marconi's Wireless Telegraph Co., Ltd., includes the provision, not only of the six new broadcasting installations, but also of elaborate repeaters and correcting apparatus for land-lines, which apparatus will be installed to improve the scheme already in operation for the exchange of programmes between Warsaw and Berlin, Prague, Vienna, and Budapest. This international exchange of programmes has come into existence almost unobserved outside the countries concerned, as the result of the activities of the International Commission for the Exchange of Broadcast Programmes.

Switzerland.—League of Nations Tests.—Last March the Secretariat of the League of Nations made a series of broadcasting experiments on short waves, following those undertaken in May and June last year. In 1928 the experiments were directed simultaneously to all overseas countries; this year the endeavour was to reach specified regions, such as North and South America, Japan, Australasia (New Zealand, Australia, the East Indies, Malacca), and the countries around the Gulf of Bengal. Listeners sent in 162 reports (compared with 92 in 1928), which showed the following results:—

American Continent.

Bad	13	Good	17
Fair	8	Excellent	18

Japan.

Bad	8	Good	1
Fair	3		

Australasia.

Fair	8	Excellent	19
Good	9		

Other Regions.

Bad	15	Good	27
Fair	4	Excellent	24

A microphone in one of the Secretariat offices was directly connected by an ordinary telephone cable with the station of Kootwijk, placed at the disposal of the Secretariat by the courtesy of the Dutch Postal and Telegraph and Telephone Administration. The cable transmission was conducted with the greatest care by the Swiss and German Telephone Administrations, so that this part of the operation was as well performed as possible. The Kootwijk station used an antenna directed towards Java, of 25 kW power, and the emission took place on wave-lengths of 38.8 and 18.4 m.—*Reuter's* (Geneva).

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Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—Melbourne.—November 27th. City Council. 6,600-V, 3-phase switchgear. (B.X. 5708.)*
November 27th. Victorian Government Railways. Automatic oil switches. (B.X. 5735.)*
October 29th. Posts and Telegraphs Department. V.i.r. lead-covered cable. (B.X. 5759.)*
December 9th. State Electricity Commission of Victoria. 3,000-kVA transformers and spares. (B.X. 5775.)*

Belfast.—October 21st. Electricity Department. Supply and delivery of circulating water pipes. (October 4th.)

Cardiff.—October 21st. Electricity Department. Supply and erection of a water-tube boiler, mechanical stokers, and fuel economiser. (October 4th.)

Chile.—Santiago.—November 14th. Chilean State Supply Department. Telegraph material. (B.X. 5746.)*

Egypt.—Cairo.—November 19th. Ministry of the Interior. One Diesel-electric generating set for the Manfalout power station. (B.X. 5720.)*
November 5th. Department of Public Health. Thirty-one electric refrigerators. (A.X. 8632.)*

Hastings.—October 23rd. Electricity Department. 22,000-V 3-phase overhead lines and underground cables, Crowhurst Section, No. 6 (approximately 7,000 yards). 400-V, 3-phase, 4-wire overhead lines and underground cable, Crowhurst Section No. 7 (approximately 4,200 yards). 400-V, 3-phase, 4-wire, overhead lines and underground cable, Whatlington Road, Section No. 8 (approximately 1,000 yards). (October 4th.)

India.—Delhi.—December 3rd. India Stores Department. Ceiling and table fans. (B.X. 5672.)*
November 12th. Battery charging motor-generators and oil switch. (B.X. 5774.)*
October 28th. House service meters for 12 months. (B.X. 5749.)*
November 18th. Two 20-kW oil-driven d.c. generators, water-softening plant, and overhead travelling crane. (B.X. 5757.)*

London.—Southwark.—October 22nd. Borough Council. Electric cable for 12 months. (September 13th.)
Central Electricity Board.—November 9th. Supply, delivery, and erection of 33,000-V overhead transmission lines in South Lincolnshire (September 27th.)
H.M. Commissioners of Works.—October 22nd. Supply of steel conduits and fittings for electric wiring, and cable and wire. (October 11th.)
Metropolitan Asylums Board.—October 30th. Installation of central battery telephone system at South-Western Fever Hospital, London Road, Stockwell, S.W. (See this issue.)

Manchester. — October 23rd. Electricity Committee. Supply, delivery and erection of four 33,000-V, 500,000-kVA rupturing capacity switch units, and two 10,000-kVA, 33,000/6,600-V indoor-type transformers. (October 4th.)

New Zealand.—Wellington.—Post and Telegraph Department. November 18th. Resistance spools. (B.X. 5716.)*
November 19th. Telephone transformers. (B.X. 5718.)*
Automatic wall and table telephones. (B.X. 5717.)*

South Africa.—Johannesburg.—October 26th. City Council. Time switches. (B.X. 5709.)* Three-phase 6,600-V truck-type switchboard panels. (B.X. 5710.)*
October 31st. Three-phase and single-phase outdoor transformers. (B.X. 5736.)*

Staffordshire.—October 31st. Education Committee. Installation of electric light in two new elementary schools in course of erection at Brierley Hill. (September 27th.)

Wakefield.—October 28th. West Riding Education Committee. Installation of electric light in the Whitwood Mining and Technical School. Education Officer, County Hall, Wakefield.

Wolverhampton.—November 15th. West Midlands Joint Electricity Authority. Two 6,600-kVA, two 1,200-kVA, and two 150-kVA transformers for Ironbridge power station. (See this issue.)

* Further particulars can be obtained at the Department of Overseas Trade (*Inquiry Room*), 35, Old Queen Street, S.W.1.

Contracts Closed.

Anglo-Belgian Telephone Cable.—
Duplication of the Anglo-Belgian land and submarine cable from La Panne to Canterbury, 75 miles.—Siemens Bros. & Co., Ltd. (The estimated cost will considerably exceed £100,000.)

Bradford.—Electricity Committee. Recommended:—
Earthing resistance for generator at Valley Road power station.—A. Reyrolle & Co., Ltd.
Six sets of current-limiting reactors at Valley Road power station.—British Thomson-Houston Co., Ltd.
Education Committee. Recommended:—
Electric lighting at Bolling Hall School (£836).—H. Taylor and Co., Ltd.

Bromley (Kent).—Town Council. Accepted:—
Electrical wiring of 63 houses on the Southborough estate (£350).—General Electrical Maintenance Co.

Burton-on-Trent.—Electricity Committee. Accepted:—
Laying cables from Tutbury to Marchington (£4,302).—Pirelli-General Cable Works, Ltd.

Cambridge.—The Fulbourn Mental Hospital Committee. Accepted:—
Installation of automatic telephones (£186).—Siemens-Schuckert, Ltd.

Chesterfield.—Electricity Committee. Accepted:—
Cable (£902).—Macintosh Cable Co., Ltd.

Douglas (I.O.M.).—Markets Committee. Accepted:—
Electric lighting at abattoir.—Lawton & Co.

Eastbourne.—Electricity Committee. Accepted:—
Cable for extensions (£8,130).—Pirelli-General Cable Works, Ltd.
Switchgear, transformers, &c. (£7,128).—General Electric Co., Ltd.

Hampton.—Metropolitan Water Board. Accepted:—
Electric motor for driving pump (£129).—English Electric Co., Ltd.

Hull.—Electricity Committee. Accepted:—
Erection of steel railway bridge at power station sidings (£3,313).—Sangwin, Ltd.
High-pressure steam pipe drains (£1,006).—Brightside Foundry & Engineering Co., Ltd.
"Creda" cookers for 12 months.—Credenda Conduits Co., Ltd. (Recommended.)

London.—Hackney.—Works Committee. Recommended:—
Seven electric vehicles for the collection and removal of road sweepings (£605 each).—Electricars, Ltd.
Westminster.—Housing Committee. Recommended:—
Electric light installation at Canal Buildings (£182).—Speedy & Eynon.
Metropolitan Asylums Board.—Recommended:—
Installation of storage battery on the T.S. *Exmouth* (£293).—Fuller Accumulator Co. (1926), Ltd.

Oldham.—Electricity Committee. Accepted.
Coupling gear at Slacks Valley.—Ferguson, Pailin, Ltd.
Meter boards.—Squire, Ashton & Sons, Ltd.

Portland.—Electricity Committee. Accepted:
Laying services (schedule price).—Pirelli-General Cable Works, Ltd.

Rotherham.—Electricity Committee. Recommended:—
4,000 yd. e.h.p. cable (£3,150).—Callender's Cable & Construction Co., Ltd.
Education Committee. Recommended:—
Heating at High School for Girls; Unity tubular electric heaters (£70).—Young, Osmond & Young, Ltd.
Wiring and installation (£22).—Ibbotson Bros. (Rotherham), Ltd.

Swindon.—Town Council. Accepted:—
Two h.p. switchgear cubicles, with control panels and metering panel (£1,605).—British Thomson-Houston Co., Ltd.
Equipment for the fitting shop at the Moredon generating station (£322).—C. Churchill & Co., Ltd.

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The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of makers of the following:—

"Louder-phones."
"Convenient" electric desk lamps.
Kent street lighting fittings.
Electrodes for the Mynost projector lamp.

Notes.

Paris International Wireless Exhibition.

In the first International Wireless Exhibition held in Paris (September 27th to October 13th) one hundred and fifteen exhibitors took part, and among the foreign countries represented were Great Britain, the United States, Germany, Austria, Holland, Switzerland, and Czecho-Slovakia. Special rooms were fitted up where demonstrations were given daily. —*Reuter's* (Paris).

As in the British show, gramophone pick-ups and amplification were everywhere in evidence. Mains current supply units were only prominent on the foreign stands. Portable and semi-portable sets were in a minority. A German firm showed interesting transmitters.

The Electrical Association for Women.

The opening fixture of this session's activities of the Association took place on September 27th, when members of the Women's Engineering Society and the E.A.W. visited the Shipping, Engineering and Machinery Exhibition at Olympia. The Councils of both organisations were invited by the management to luncheon, presided over by Dr. Hele-Shaw, ad the members were entertained at tea, when they were welcomed to the Exhibition by Mr. F. W. Bridges. Mrs. Hammer thanked Dr. Hele-Shaw, Mr. Bridges, and the management, on behalf of both Associations.

On September 28th, the Surrey Branch of the Association of Teachers of Domestic Subjects again held their annual meeting at the E.A.W. Club Room, 46, Kensington Court, W.8. The meeting was followed by a lecture on "The Commonsense Handling of Electric Appliances," by Mr. R. W. Kennedy, arranged at the special request of the teachers.

The opening meeting of the autumn session of the Birmingham and Midland Branch of the Association was held on September 26th, when about 100 members had the pleasure of hearing two excellent speakers. Miss C. Haslett spoke on the need to educate women and girls in the use of electricity, and Miss Palmer dealt specifically with "Electricity in the Schools." Miss Barrie, M.A., the headmistress of King Edward's High School for Girls, presided.

Mr. G. S. Francis, of the British Electrical Development Association, delivered a lecture to the members of the South Wales and Monmouthshire Branch of the Association at the Engineers' Institute, Park Place, Cardiff, recently, on "The Influence of Electricity on Public Health," and he dealt with it in a skilful manner from many different angles.

A very successful meeting was held by the Birmingham and Midlands Branch of the E.A.W. on October 10th, at Walsall. The Mayor of Walsall presided, and Mr. Francis (E.D.A.) gave a stimulating and interesting lecture on "Modern Tendencies in Architecture, Furnishing, and Lighting Designs, and the part Electricity plays therein."

The winter programme of the Glasgow Branch of the Association began on October 10th, when the premises of the United Dairies Co., Ltd., where many of the latest electrical developments in dairy appliances are installed, were visited. The first talk of the session on October 21st is by Mr. Alex. McKinnon, whose subject is "Domestic Electrical Apparatus."

Railway Electrification in Spain.

According to the *Journal* of the British Chamber of Commerce in Spain, a Royal decree has recently been issued recording the appointment by the Government of a technical committee to advise the Minister of Public Works on detail matters relating to the electrification of railways. The committee is to be presided over by a senior Government engineer and it will be made up of three civil, one mining, and one mechanical engineers, all appointed by the Minister. The committee will be assisted by an advisory sub-committee, consisting of a representative of each of the four leading railway companies, a representative of the electrical machinery industry, and an engineer from the railway inspection division. The new committee will carry on the work of the Commission which was appointed by a decree of January 14th, 1928, for the preliminary study of the subject.

Reports of Inspectors of Mines.

Several of H.M. Inspectors' reports for the year 1928 on the inspection of mines under the Coal Mines Act have been issued recently. In the report on the Yorkshire Division, a detailed account is given of a serious accident caused by an explosion of firedamp. The inspector discusses the causes of the accident, which, in his opinion, originated at a fan-motor switch, and comments on the system of auxiliary ventilation in use in the seam in which the accident occurred.

Notes on the use of electricity, safety lamps, &c., are included in the report, which (post free 1s. 1d.) can be obtained from H.M. Stationery Office, at York Street, Manchester.

The Scarborough Extensions.

The formal opening of the extensions of plant at the Scarborough Corporation electricity undertaking was performed on October 11th by Sir Harry Haward, vice-chairman of the Electricity Commissioners, in the presence of a large assembly. The new generating plant represents an outlay of £50,000, and capital expenditure has been increased during the present year by £104,657 to £311,697. The units sold during the past year totalled 3,938,426, an increase of 709,207 on the figure of the previous year. In 1894, when the works were opened by a private company, at a cost of £25,987, the sale of units was 86,594. Since the Corporation took over the undertaking from the Scarborough Electric Supply Company in 1926 the works have been remodelled. Additions to meet the increased demand include a 1,875-kW turbo-alternator, together with a 1,000-kW frequency changer, a 1,000-kW motor-convertor, and a Babcock & Wilcox water-tube boiler, which were, in the main, ready for commercial load in September, 1928. Further extensions comprised a 3,750-kW turbo-alternator, two water-tube boilers, and coal and ash-handling plant. Orders have been placed for the installation of another 3,750-kW turbo-alternator, to be completed about March next. The two boilers are each capable of evaporating 37,500 lb. of water per hour and are automatically fired by chain-grade stokers. The coal is elevated to the bunkers above the hoppers and the ash is automatically discharged outside the boiler house. The circulating water is obtained from artesian wells, supplemented by a supply from the town's mains, and is cooled by means of two large cooling towers.

After the works ceremony the party was entertained at luncheon, at which the Mayor presided. In proposing the toast of "The Electricity Commissioners," the Mayor said they had the assurance that they would suffer no loss from any interference on the Commissioners' part.

Sir Harry Haward, responding to the toast, referred to the criticism of the proposed Battersea Park power station. On that particular point he hoped that before it was many weeks older the public would be a good deal wiser on that matter than it was at that time. Congratulating the Scarborough Corporation on the remodelled condition of its station, Sir Harry said he had been very interested in some of the ancient pieces of plant which he had seen that day, as reminders of the original station of the old company. He was glad to note that during the three years the Corporation had been in control of the electricity undertaking at Scarborough prices to consumers had been reduced. In the same period it had remodelled its plant, and, with great public spirit, had taken the supply to a very large outside area, amounted to 105 square miles. A decision on the North-East England Electricity Scheme, which included Scarborough, might be expected within a few weeks. Contracts amounting to ten millions, under the "Grid" scheme, had already been let. It was going to be a costly business, but the savings that could and would be effected by common working would be enormous. In a reference to the controversial subject of overhead lines and the preservation of the beauty of the countryside, Sir Harry said the towers had been designed by Sir Reginald Blomfield, and everything had been done, from an artistic point of view, that could be done without impairing utility. He thought that when people saw the thing in actual operation they would not be alarmed. So far as Scarborough was concerned, the lines would run well behind the town, and would not interfere at all with the beauty spots which were so important a factor in such a place.

The Mayor expressed warm tributes to Mr. Spencer Hawes, the Corporation's professional adviser in the acquisition of the electricity undertaking, to Mr. E. J. Jarvis, the borough electrical engineer, and to the contractors, who, he said, had striven to discharge their duties to the best of their powers.

Mr. Jarvis responded on behalf of the engineers and staff, and Mr. George C. Usher (International Combustion, Ltd.) for the contractors.

Fuel Consumption Returns, 1928-29.

The annual returns of the Electricity Commisioners entitled "Generation of Electricity in Great Britain, year ending March 31st, 1929" (H.M. Stationery Office, price 1s. 6d. net) have been issued this week.

Metal Arc-Welding Tests.

Since the advent of metal arc welding great advancement has been made in this branch of the foundry business. There is, however, still too much of the feeling that success depends upon the operator, but a man can be so trained in the correct procedure that it is more difficult to do bad work than good

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Welding is a metallurgical operation which is recognised as part of the foundry industry, and no foundry is complete without its welding equipment. No foundry can afford to use anything but the best electrodes, and the choice should be made irrespective of price, after the welds have been subjected to microscopic and mechanical application and the required standard is reached.

Heavily coated electrodes are to be recommended for use on steel castings, and as the result of many years' experience, Messrs. Alloy Welding Processes, Ltd., have produced "A.W.P." No. 265 Electrode (Bulletin No. 61), the deposit from which is said to be consistently homogeneous and to give a maximum stress of 30 to 31 tons per sq. in., with a yield point of 22.5 tons per sq. in. and an elongation of 14.18 per cent.

At one time it was considered impossible for welds made by metallic arc welding to permit of hot bending unless previously subjected to forging in order to acquire the necessary mechanical qualities. This difficulty has, it is claimed, been overcome by the introduction of "A.W.P." special tensile "A" and special tensile "B" electrodes, and welds made with these two types can be bent hot to any desired shape, either by hand or by the aid of hydraulic machinery, without any previous mechanical treatment. Satisfactory tests were carried out in connection with "A.W.P." electrodes of special "A" and special "B" types by the British Engine, Boiler & Electrical Insurance Co., Ltd.

Local Society.

Mr. James Orr, president of the Paisley Association of Electrical Engineers, in his presidential address to the Association recently, discussed such topics as tolerance and making allowance for any trying to see other people's viewpoint. During the evening a presentation was made to Mr. Robert Craig in recognition of the services rendered by him as honorary pianist since the inception of the Association.

Appointments Vacant.

Three whole-time examiners of applications for patents of inventions in the Industrial and Commercial Property Registration Office, Irish Free State Department of Industry and Commerce. Meter Superintendent for Nuneaton Corporation. Assistant electrical engineers in the Admiralty Service. Power station superintendent for the Oxford Electric Co., Ltd. Clerk for Bingley Urban District Council Electricity Department. Meter Superintendent for the Electrical Branch of the Public Works Department of the Government of Nigeria. Mains assistant (£182) for the Borough of Southport Electricity Department. Generating station superintendent (£300) for the Horsham U.D.C. Electricity Department. General Clerk (£190) for the Walton-upon-Thames U.D.C. Electricity Department. Plumber-jointer for Barrow-in-Furness Corporation. (See our advertisement pages to-day.)

Automatic Street Traffic Control.

According to the *Daily News*, talks between the Marylebone Council, the Ministry of Transport, Scotland Yard, and a firm of electrical engineers are nearing conclusion, and by November 1st it is probable that work will commence on the installation of a system of automatic light traffic control signals from Oxford Circus along the entire length of Oxford Street to the Marble Arch. This will be the first serious experimental effort in London to relieve the police of traffic duty and place them on urgently needed police work, and also to standardise a system which it is hoped will lead to less traffic congestion and greater safety for pedestrians. The red light will mean "stop," the green "proceed" after a hold-up by the red, and the amber (the middle positioned light) "be ready for a change of traffic flow." Oxford Street, a wide straight road with heavy east and west traffic, and many north and south intersections, is almost ideal for the experiment. Scotland Yard is believed to have raised points regarding the flow periods and the safety of pedestrians which will probably be met in the working of the lights. The system most likely will be in full working order in the New Year. If after six months it is found to be satisfactory, a suggestion is expected to be placed before the Westminster City Council for a similar installation in Piccadilly and the Strand.

"H.M.V." Radio-gramophones.

"His Master's Voice" gramophones are too well known to need any introduction. Electrically-driven models and electrical recording are not new either, but the radio-gramophone demonstrated last week by the Gramophone Co., Ltd., is a new instrument. Housed in a handsome wood cabinet some 42 in. high, 19 in. wide, and 21 in. deep, the set is self-contained and designed for operation off domestic a.c. mains at 100-130 or 200-240 volts and 40-60 cycles. An electro-magnetic "pick-up" is fitted, and also a new type of induction disk turntable motor, which maintains a very even speed; an automatic brake stops the motor at the end of each record. The loud-speaker is of the moving-coil pattern, and reproduces very well indeed over the full recording frequency range of from 40 to 5,000 cycles. The wireless set incorporates four valves (h.f.—d.—2 l.f.), and all the receiving parts are screened in a metal case. The controls and switches are mounted on a panel which is illuminated by a concealed pilot lamp, which functions in conjunction with the "on and off" switch. A radio-gramophone change-over switch and a wave-band switch (220 to 550 and 700 to 2,000 metres) are provided, as well as reaction, aerial coupling, fine tuning, and volume controls, tuning being effected by drum-conrolled gang condensers. The outfit is very powerful, and functioned well.

In order that all who handle the company's products may be able to give the fullest services to the public, it has started at the London Polytechnic a special course of lectures in elementary radio-gramophone production. Captain P. P. Eckersley, for years the chief engineer of the British Broadcasing Corporation, and now holding an important position with the Gramophone Company, made it his first duty to supervise the course of lectures, and gave the opening address on October 8th. The evening lectures are delivered by Mr. S. T. Short, A.M.I.E.E., and the sixteen discourses and demonstrations will cover the entire field for dealers, salesmen, service staff, and others engaged in the radio-gramophone industry. Similar courses of instruction are to be given in such centres as Manchester, Liverpool, Birmingham, Southampton, Hull, Bristol, Cardiff, Glasgow, Edinburgh, Newcastle, Leeds, Bradford, Sheffield, Nottingham, Leicester, Norwich and Brighton, by arrangement with the local technical schools. In each case the price of one pound is charged for the complete course. For those who are unable to attend the evening lectures, a correspondence course will be available. Letters should be addressed to the Technical Education Department, the Gramophone Company, Ltd., 363, Oxford Street, London, W.1.

Sparking and Brush Temperature.

Sparking at the brushes of direct current electrical machinery is often aggravated by the heating of the brushes and commutator. Mr. W. E. Warner writes us that in many cases machines will run sparklessly until thoroughly heated up, when severe sparking may start. This is due to the alteration in the contact resistance at the brushes, which falls as the temperature rises. Up to temperatures of 95 deg. F. there is no great change in the contact resistance, but when this temperature is passed there is a rapid fall. At temperatures between 135 and 167 deg. F. the contact resistance at the positive brushes will be only 80 to 50 per cent. of the resistance at 95 deg. F., while at the negative brushes the corresponding resistance will only be some 25 to 10 per cent. (By negative brush is meant the brush at which the current flows from the brush to the commutator.) The alteration in the contact resistance causes increased sparking, more especially as the contact resistance at the positive and negative brushes does not alter in like proportion.

This shows the importance of keeping the commutator and brushgear cool, if necessary employing artificial means to do so.

The Life of Mercury-rectifier Bulbs.

In a recent issue of *A.E.G. Mittelungen*, Herr H. Schlensener discusses the question of the life of the glass bulbs used in mercury rectifiers. As a result of information obtained from a large number of users, the author considers that 10,000 hours may be regarded as the figure representing the average life of such bulbs.

Electrical Testing Laboratory in Belgium.

On the initiative of the Comité Electrotechnique Belge, arrangements are now in hand for the establishment in Brussels of a central laboratory for the testing of electrical equipment. It is expected that at first the greater part of the work of the laboratory will consist of testing apparatus submitted in order to secure the quality mark of the Comité Electrotechnique Belge.

Electric Locomotives in Japan.

In a recent issue we briefly referred to the development which is taking place in the electrical engineering industry in Japan, instances being quoted of contracts for large turbines and generators for Japanese power stations having been entirely carried out in that country. According to the *Far Western Review*, seven express passenger electric locomotives have recently been completed in the works of the Imperial Government Railways of Japan, in Tokio, the parts of the engines having been built by several concerns in Japan to common drawings supplied by the railway authorities. The engines are of the twenty-wheel type, *i.e.*, a four-wheel bogie at each end and twelve driving wheels mounted on six axles, each of which is driven through nose-suspension type single-gearing by its own motor, the gear ratio being 3.45 to 1. The motors are designed for a terminal voltage of 675 V, they having each a one-hour rating of 230 kW at 370 A and at a speed of 786 r.p.m. The total hour-rating of the locomotives is 1,350 kW and the maximum and average speeds are 59½ and 37½ m.p.h. with a load of 500 tons. The auxiliary equipment of the engines comprises a 2-3 kW motor-generator and a 56-Ah battery for supplying power to the l.p. auxiliary circuits, and a motor-driven blower delivering 5,200 to 5,300 cu. ft. of air per hour. The engines are equipped with compressed-air, vacuum, and hand brakes; the compressed air is supplied by a motor-driven compressor having a capacity of 45,200 cu. ft. per hour, while the vacuum is maintained by a 3 to 4-kW pump. The bogie wheels have a diameter of 2 ft. 9 in., and the driving wheels one of 4 ft. 1 in. The wheel base between the first and last axle is 61 ft. 5 in., the overall length of the engine 68 ft. 2½ in., and the overall width 9 ft. 2½ in.

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Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

On Monday next Professor E. W. Marchant, D.Sc., delivers his address as chairman of the Mersey and North Wales (Liverpool) Centre of the Institution of Electrical Engineers. Prof. Marchant has had a very distinguished career, which commenced at the City and Guilds of London College, South Kensington, where he was Siemens Medallist. He was also a Granville Scholar of the University of London and a Salamons

Lafayette [*London.*

Professor E. W. Marchant, D.Sc.,

Chairman of the Mersey and North Wales (Liverpool) Centre of the I.E.E.

Scholar of the Institution of Electrical Engineers. After serving a short apprenticeship, he became superintendent of Lord Blythswood's laboratory at Renfrew for a period of three years. In 1900 he was appointed lecturer at Finsbury Technical College, and in the following year went to the University of Liverpool, first as lecturer in electro-technics, and later (in 1903) as David Jardine Professor of Electrical Engineering, a position which he still holds.

In 1908 Prof. Marchant was appointed to give evidence before the Canal Commission on electrical haulage on canals, and he was a member of the Lancashire Anti-Submarine Committee from 1917 to 1919.

He became an associate of the Institution in 1898, an associate member in 1902, and a member in 1906. In 1912-13 he was acting chairman of the Manchester Local Section and chairman in the following year. From 1914 to 1917 he was an ordinary member of the Council, and was vice-president from 1917 to 1920. Upon the formation of the Liverpool Sub-Centre in 1920 he became chairman. He delivered the Kelvin Lecture on "High Frequency Currents" in 1927. In addition to his Institution activities, Prof. Marchant is interested in the Liverpool Engineering Society, and was its president in 1915-16.

Prof. Marchant has a large amount of published work to his credit, including a number of papers read before the Institution and the British Association for the Advancement of Science, at whose meetings he is a familiar figure.

According to the newspaper Press, Sir Felix Pole, chairman of Associated Electrical Industries, Ltd., recently left for America to confer with the heads of the General Electric Co. of the U.S.A.

Mr. E. E. Garrard, A.M.I.E.E., of 56, Kingsway, W.C., who has had over 20 years' central station experience, has joined Derby Cables, Ltd., Derby, as manager for London and the South-Eastern Counties.

Sir Hugo Hirst has been re-elected master of the Worshipful Company of Glaziers, and is playing the leading part in a scheme for the rebuilding of the hall of the company which was destroyed in the great fire of London.

Alderman A. J. West, who has accepted the mayoralty of Taunton, is a partner in the firm of Henry West & Son, electrical engineers, of 31, High Street. He has been a member of the Corporation for 15 years.

The Industrial Australian and Mining Standard states that it is understood that upon his retirement in November next from the chairmanship of the Federal Capital Commission, Sir John Butters will become a resident director in Sydney of Messrs. Babcock & Wilcox, Ltd.

Mr. William Clifton, who is attached to the electrical department of Harworth Colliery, Yorks., was married on October 5th to Miss Kathleen Cottam. His colleagues presented him with a tea service.

On completing 20 years' service with Messrs. M. W. Woods, Ltd., electrical manufacturers, of Butt Road, Colchester, Mr. F. Parker has been presented with a clock, and Mr. C. Gasson with a silver teapot, by Mr. M. W. Woods, managing director of the firm.

Mr. J. B. Parker, for some years general manager of the Tees-side Railless Traction Board, has been appointed general manager of the Aldershot and District Traction Co. He was formerly assistant engineer to the Sheffield Corporation Tramways and Motor-'bus Department.

Mr. G. A. Struthers, who has for the past eighteen months been in charge of the beam station at Bodmin, has been appointed engineer-in-charge of the Post Office radio station at Hillmorton, Rugby. He succeeds Mr. H. Faulkner, A.M.I.E.E., who has been transferred to the headquarters of the engineer-in-chief of the G.P.O. in London.

Mr. A. P. M. Fleming, C.B.E., M.Sc., of the Metropolitan-Vickers Electrical Co., Ltd., has been appointed by the Board of Directors of the American Institute of Electrical Engineers to be honorary secretary for England for the two-year term, August, 1929, to August, 1931. The local honorary secre-

Mr. A. P. M. Fleming, C.B.E., M.Sc.,

Honorary Secretary in England for the American I.E.E.

taries are appointed under Section 46 of the Constitution of the Institute. The duties of the appointment include assisting the Board with regard to applications for membership extending courtesies to travelling members, and other services. Mr. Fleming succeeds Mr. C. le Maistre, whose term has just expired.

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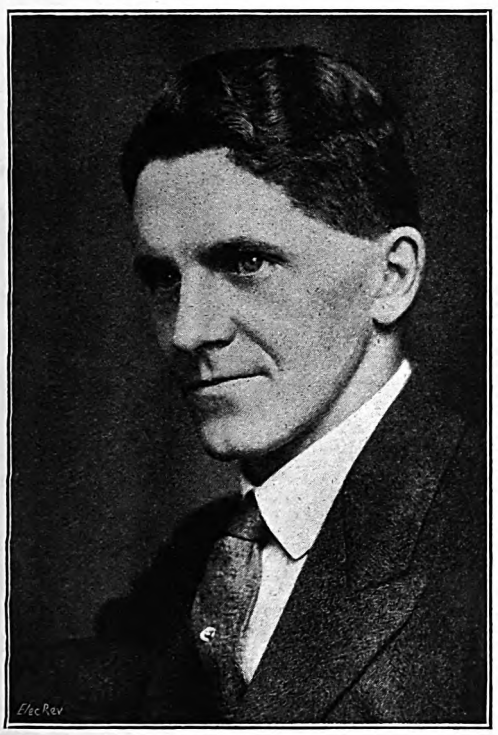
Mr. Harold E. Midgley, M.A., M.Inst.C.E., director, chief engineer and general manager of the Foundation Co., Ltd., has resigned to join the board of Ruths Steam Storage, Ltd.

Plymouth Corporation Electricity Committee has appointed Mr. R. W. Weeks (gas department) street lighting superintendent and gas examiner for the city at his present salary, *viz.*, £400 per annum, subject to a contribution by the Gas Committee of £50 per annum towards the salary in respect of the duties of street lighting inspection in the Devonport area.

Mr. Howard Long, A.M.I.E.E., latterly manager, illumination department, Metro-Vick Supplies, has resigned his position



Elliott & Fry [*London.*

Mr. H. Long, A.M.I.E.E.,

who is joining Benjamin Electric, Ltd.

to take up an appointment with the Benjamin Electric, Ltd., in charge of their lighting engineering services. Mr. Long's photograph accompanies these notes.

Mr. Robert Illingworth, of Cardiff, has been appointed deputy electrical engineer to the Plymouth City Council, at a salary of £555 per annum, rising by annual increments of £15 to £600 per annum.

The marriage has taken place at St. Paul's Church, Colwyn Bay, of Mr. Wallace G. M. Lywood, A.M.I.E.E., youngest son of Mr. W. J. Lywood, of The Mount, Harnham, to Miss Margaret Lord, eldest daughter of Dr. Robert E. Lord, J.P., of Penlan, Colwyn Bay.

One of the employés of the Automatic Telephone Co., Ltd., Liverpool, Mr. Arthur Hankey, has been elected an alderman on the Bootle Town Council. Before joining the A.T.M. staff he was in the service of Chadburn's Ship Telegraph Co.

Councillor J. Boothman, who has been selected as the next mayor of Clitheroe (Lancs.), is chairman of the Corporation Electricity Committee.

We are officially informed that Mr. G. J. Hollyer, who has been the borough electrical engineer of Loughborough for the past 2½ years, has been appointed borough electrical engineer and manager at Torquay. He succeeds Mr. H. F. G. Woods who recently took up the position of general manager to the East Devon and Exe Valley Electric Supply Co.

The Department of Overseas Trade announces that Mr. C. J. Kavanagh, Commercial Secretary at Berlin, is to be succeeded by Mr. R. F. P. Edwards, D.S.O., British Consul at Port-au-Prince, Haiti. Mr. Edwards has already held Consular appointments in Germany, and expects to take up his duties in Berlin early in November.

Mr. T. R. McCandlish, constructional engineer to the Torquay electricity undertaking, has been appointed as clerk of works to the Croydon Corporation electricity undertaking.

Mr. C. W. Reeve, who has recently been acting as assistant to the chairman of the Associated Equipment Co., has been elected to the board and appointed managing director of the company. After several years as works accountant and joint manager to the A.E.C., he was appointed chief purchasing and stores superintendent to the Underground group of companies. This position he held from 1924 to 1928. Mr. Reeve was a member of the Council of the M.T.A. from 1920-1923, and was president of that body in 1922-1923. In his earlier business life he served with the Premier Gas Engine Co at Sandiacre, Derbyshire, and was for three years with the British Westinghouse Company at Trafford Park. He joined the A.E.C., then at Walthamstow, in 1915.

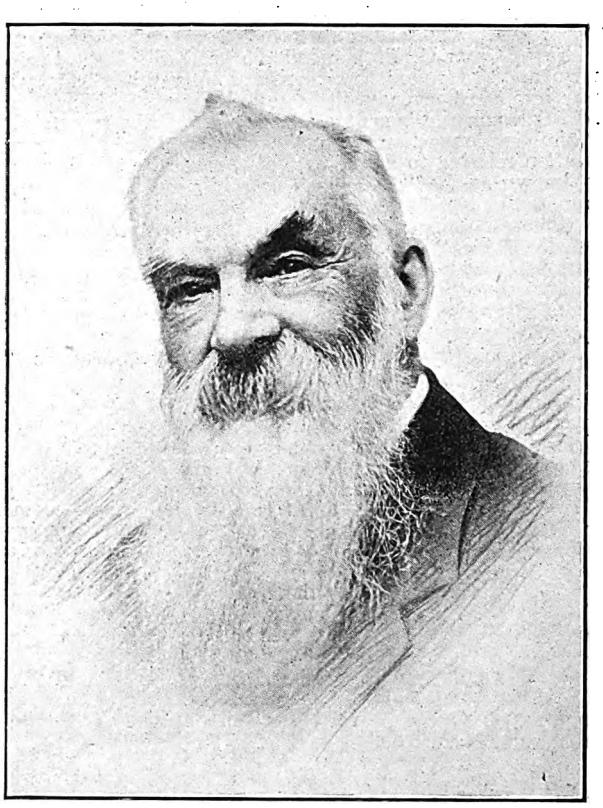
Obituary.—Mr. H. N. Bickerton.—We regret to record the death, which occurred on October 6th at his residence, Thornycroft Hall, Siddington, Chelford, of Mr. Henry Nield Bickerton, M.I.M.E., &c., chairman and managing director of the National Gas Engine Co., Ltd., and a director of Mirrlees, Bickerton & Day, Ltd. Mr. Bickerton founded the National Co. in the year 1890 and the other company named in the year 1907. He was the inventor of improvements in internal-combustion engines. He was born in 1857, the son of Mr. Samuel Bickerton, of Oldham.

Mr. Charles J. Todd, for the past eight years chief assistant at the Horsham U.D.C. electricity undertaking (late of Abertillery U.D.C. and the Royal Naval Air Service), died at the Royal Sussex Hospital on Sunday last as the result of injuries received in a motor accident on the London-Brighton Road a few hours previously.

Mr. S. H. Webb.—The death occurred last week of Mr. S. H. Webb, A.M.I.E.E., of Leicester, at the age of 74 years. He was a past president of the Electrical Contractors' Association there. The business with which he was associated (F. Webb & Son, electrical contractors, Leicester) was founded by his father, Mr. Frederick Webb, in 1861.

Mr. E. W. Rollins.—Mr. E. W. Rollins, president and chairman of an American banking house, and described as a pioneer in the development of electrical power development in the U.S.A., recently passed away.

Mr. W. Bannister.—Mr. William Bannister, J.P., to whose death on October 1st we made brief reference in our last issue, was a typical Ulster man. Born at Lisburn, and educated first at the Grammar School there, he went later to Belfast to complete his studies. He had a natural bent toward the chemical trade, and at an early age he became managing partner in the late firm of Messrs. W. & H. M. Goulding, manufacturing chemists, &c., Cork, from which firm he retired in 1887. He was one of the founders, and a Fellow, of the Society of Chemical Industry. When he came to reside in England he quickly became a prominent figure in the storage battery business. He was an original director, and for the past 27 years chairman, of the Chloride Electrical Storage Co., Ltd. He transformed this undertaking from a small concern occupying one building into the vast battery



The late Mr. W. Bannister,

Chairman of the Chloride Electrical Storage Co., Ltd.

making plant, now the largest in the British Empire, at Clifton Junction, near Manchester. While in Ireland he helped benevolent and social reform organisations and the Church. He also showed a keen commercial instinct. In his domestic circle Mr. Bannister was particularly happy. He passed away in his 82nd year; he has left two sons and five daughters, all married.

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Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Lamlite Signs, Ltd.—Private company. Registered October 5th. Capital, £1,000 in £1 shares. Objects: To carry on the business of designers and manufacturers of and dealers in animated, scintillating, mechanical, electrical, and other advertising signs, &c. The directors are: T. Lamb, W. R. Sharp, H. L. Fry, C. W. Hails, J. P. Harding, H. E. Hails, and P. Cooper, addresses not stated; C. I. Russell, 231, Jesmond Road, Newcastle-on-Tyne; B. Gill, 26, Northumberland Street, Newcastle-on-Tyne; W. J. Sloan, address not stated; C. Millican, Market Street, Newcastle-on-Tyne. Registered office: 5/7. Savile Row, Newcastle-on-Tyne.

Belfast Radio & Electrical Co., Ltd.—Private company. Registered in Belfast on September 27th. Capital, £1,000 in £1 shares. Objects: To take over from R. McFarland the business of a wireless dealer, carried on by him as the Belfast Radio & Electrical Co. The directors are: R. McFarland, 105, Wandsworth Road, Belfast, wireless dealer; J. Doherty, 133, Oldpark Road, Belfast, wireless dealer. Secretary: Viola E. M. McFarland. Registered office: 17, Queen Street, Belfast.

Vector Electrical Co., Ltd.—Private company. Registered October 7th. Capital, £1,000 in £1 shares. Objects: To acquire the business of an electrical engineer now carried on by E. E. Walker as the "Vector Electrical Co.," at 40, Broadfield Road, Sheffield. The subscribers (each with one share) are: E. E. Walker, 40, Broadfield Road, Sheffield, electrical engineer; B. P. Burkinshaw, Crowgate, South Anston, nr. Sheffield, cashier. Registered office: 40, Broadfield Road, Sheffield.

Salaman Handoll, Ltd.—Private company. Registered October 9th. Capital, £15,000 in £1 shares. Objects: To acquire (1) from G. E. Handoll the goodwill of the business known as the Handoll Engineering Company hitherto carried on by him at 23, Broadwall, Stamford Street, S.E.1; (2) from R. A. Salaman the benefit of the business hitherto carried on by him in connection with the manufacture of a certain invention relating to the control of theatrical and other lighting, known as the "Salaman Control"; and (3) from R. A. Salaman the benefit of a contract entered into by him with the Albany Engineering Co., Ltd., for the purchase of the goodwill of the said company and certain leasehold property, plant, &c., and to carry on the business of electrical, mechanical and consulting engineers, ironfounders, &c. The permanent directors are: R. A. Salaman, Homestall, Barley, Royston, Herts.; G. E. Handoll, 4, Ravenna Road, Putney, S.W.; M. H. Salaman, Ruckman's, Oakwood Hill, Ockley, Surrey. Registered office: 80, Ossory Road, S.E.1.

Waldron Electrical Manufacturers, Ltd.—Private company. Registered October 11th. Capital, £1,500 in £1 shares. Objects: To acquire the business of electrical and general engineers, manufacturers, factors and merchants now carried on by G. C. Jeremiah and L. Goldstone at Waldron House, Belle Vue Street, Swansea, as the "Waldron Electrical Co." The permanent directors are: G. C. Jeremiah, The Willows, Glanmor Park Road, Swansea; L. Goldstone, 139, Western Street, Swansea. Secretary: L. Goldstone.

Official Returns of Electrical Companies.

Full Light Anti-Dazzle Co., Ltd.—Second debenture dated September 28th, 1929, to secure £525, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: F. S. Leuw, 46, Sheldon Avenue, Highgate.

P. Mordant, 115-117, Cannon Street, E.C., was appointed receiver and manager on October 2nd, under powers contained in debenture dated June 19th, 1929.

Walsall Electrical Co., Ltd.—Mortgage on 57, 59, 61 and 63, Bridge Street, Walsall (freehold), dated September 12th, 1929, to secure all moneys due or to become due from the company to the Midland Bank, Ltd.

Magnus Volk, Ltd.—Capital, £5,000 in £1 shares. Return dated May 27th, 1929. 4,102 shares taken up. £102 paid. £4,000 considered as paid. Mortgages and charges, nil.

Cooke & Stevenson, Ltd.—Capital, £1,000 in £1 shares. Return dated May 10th, 1929. All shares taken up. £1,000 considered as paid. Mortgages and charges, nil.

D.P. Battery Co., Ltd.—Capital, £100,000 in £1 shares. Return dated April 9th, 1929. All shares taken up. £28,000 paid. £72,000 considered as paid. Mortgages and charges, nil.

Lancashire Telephone Systems, Ltd.—Issue on June 1st, 1929, of £350 debentures, part of a series already registered. (Filed October 5th.)

Solidite & Synthetic Mouldings, Ltd.—Debenture dated September 23rd, 1929, to secure amounts payable under a guarantee for not more than £5,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: J. A. Shaw, and A. W. Shaw, Roehampton House, Roehampton Lane, S.W.15.

Shoreham & District Electric Lighting & Power Co., Ltd.—Issue on October 1st, 1929, of £1,300 6 per cent. ten-year notes, part of a series already registered.

Power Development Co., Ltd.—Capital, £22,000 in 20,000 6 per cent. cumulative preference shares of £1 each and 40,000 ordinary shares of 1s. each. Return dated August 1st, 1929, 17,500 cumulative preference and 30,000 ordinary shares taken up. £11,500 paid on 10,000 preference and 30,000 ordinary shares. £7,500 considered as paid on 7,500 preference shares. Mortgages and charges, nil.

L. Weekes (Luton), Ltd.—Capital, £6,000 in £1 shares. Return dated June 13th, 1929. All shares taken up. £6,000 considered as paid. Mortgages and charges,: £3,000.

R. F. Winder, Ltd.—Capital, £12,000 in £1 shares. Return dated June 11th, 1929. 10,300 shares taken up. £10,300 paid. Mortgages and charges, £5,000.

S. H. Heywood & Co., Ltd.—Capital, £50,000 in 18,000 preference and 32,000 ordinary shares of £1 each. Return dated July 4th, 1929. All shares taken up. £22,001 paid. £27,999 considered as paid. Mortgages and charges, nil.

Embleton & Barker, Ltd.—Capital, £1,000 in £1 shares. Return dated April 2nd, 1929. All shares taken up. £500 paid. £500 considered as paid. Mortgages and charges, nil.

Birkdale District Electric Supply Co., Ltd.—Capital, £50,000 in £5 shares. Return dated May 28th, 1929. 9,200 shares taken up. £46,000 paid. Mortgages and charges: £25,000.

Witton-James, Ltd.—Capital, £6,100 in 2,000 preference and 4,000 ordinary shares of £1 each, and 2,000 deferred shares of 1s. each. Return dated July 23rd, 1929. All shares taken up. £2,000 paid on 2,000 preference shares. £4,100 considered as paid on 4,000 ordinary and 2,000 deferred shares. Mortgages and charges: £25,000.

Tungsram Electric Lamp Works (Great Britain), Ltd.—Capital, £100 in £1 shares. Return dated June 13th, 1929. Ten shares taken up. £10 paid. Mortgages and charges, nil.

West Gloucestershire Power Co., Ltd.—Capital, £685,000 in £435,000 6½ per cent. participating preference stock, £235,000 ordinary stock, and 15,000 ordinary shares of £1 each. Return dated May 25th, 1929. 350,000 preference stock and 235,000 ordinary stock issued. £350,500 paid on £350,000 preference stock and £500 ordinary stock. £234,500 considered as paid on £234,500 ordinary stock. Mortgages and charges: £350,000. Return of allotments, made up to July 26th, 1929, shows a further £85,000 preference stock issued and fully called up.

London Platino-Brazilian Telegraph Co., Ltd.—Capital, £400,000 in £10 shares. Return dated September 18th, 1929. 37,480 shares taken up. £374,800 considered as paid. Mortgages and charges, nil.

Electrical Contracts & Maintenance Co. (1925), Ltd.—Capital, £3,000 in £1 shares. Return dated April 17th, 1929. 2,305 shares taken up. £2,305 paid. Mortgages and charges at date of return: £100 (since paid off).

Truro Electricity Supply Co., Ltd.—Capital, £5,000 in £1 shares. Return dated May 9th, 1929. 404 shares taken up. £404 paid. Mortages and charges, nil.

West India & Panama Telegraph Co., Ltd.—Capital, £2,445,630 in 34,563 first preference, 10,000 second preference, and 200,000 ordinary shares of £10 each. Return dated August 30th, 1929. 34,563 first preference, 4,669 second preference, and 88,321 ordinary shares taken up. £1,275,530 considered as paid. Mortgages and charges: £89,100

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City Notes.

Norwich Electric Tramways Co.

The accounts for the year ended June 30th last record a net profit of £22,691 (against £21,988 for 1927-28); £2,417 brought forward is added, making £25,108. It is proposed to transfer £10,000 to reserve (as last year) and to pay a final dividend of 2½ per cent., making 5 per cent. for the year, as compared with 4½ per cent. in the preceding year, leaving £1,908 to be carried forward. The report states that the motor-omnibus services have been augmented, and the number of 'buses now in operation is 19. Meeting: October 25th.

Puebla Tramway, Light and Power Co.

There was a decrease in the net profit during 1928, the figures being $1,256,247 (Mex.), against $1,372,378. After meeting all expenses and debentures and note interest and sinking funds there was a deficit of £2,076. Depression in Mexican industry is blamed for lower receipts, while operating expenses were higher. The debt of the Puebla Municipality is said to be increasing, and litigation regarding the agreement between the company and the Municipality is in progress.

Brazilian Traction, Light and Power Co.

A quarterly dividend of 50 cents per share has been declared on the company's no-par-value ordinary shares.

Indo-European Telegraph Co., Ltd.

A dividend at the rate of 5 per cent. per annum, free of tax, has been declared in respect of the half-year ended June 30th last.

Marconi International Marine Communication Co., Ltd.

An interim dividend of 5 per cent. has been declared, against 7½ per cent. last year.

Urban Electric Supply Co., Ltd.

The interim dividend on the ordinary shares is again at the rate of 6 per cent. per annum.

Anglo-American Telegraph Co., Ltd.

Dividends of £1 10s. per cent. on the preferred stock and 15s. per cent. on the ordinary stock have been declared for the quarter ended September 30th.

Stock Exchange Notices.

Application has been made to the Committee to allow the following to be officially quoted:—

Aron Electricity Meter, Ltd.—£103,082 6 per cent. participating income debenture stock.

Power Corporation of Canada, Ltd.—31,826 shares of common stock of no par value.

Dutch Company.

Philips Gloelampenfabriek Maatschappij, Eindhoven, is making a new issue of 5,274 6 per cent. cumulative preference shares of 1,000 gulden, each of which are being offered at 1,130 gulden, and 16,407 new ordinary shares of the same value, the subscription rate for which is 1,250 gulden.

The directors have called an extraordinary meeting for November 4th for the purpose of approving a resolution increasing the total capital of the company from £12,500,000 to £21,000,000.

Stocks and Shares.

Tuesday Evening.

Stock Exchange markets have attained a more composed condition than they occupied at the beginning of the month, but the fact that the Hatry group settlement is still in the air tends to check business, owing to the uncertainty which must continue to prevail until this is out of the way. The settlement was to have taken place, as originally fixed, on October 24th—that is, Thursday in next week—but a postponement has been found necessary; and, at the time of writing, the actual date remains indefinite. The flurry which occurred in America, and which brought down so considerably the prices of a great many stocks and shares, of the utility order, has given place to quieter markets, though the international speculative counters, such as Brazilian Tractions and Hydro-Electrics have come to be regarded, move with violent fluctuations. The firmest market in the Stock Exchange is at present that for Home Railways. The monetary outlook is regarded as warranting the expectation that the Bank Rate is not likely to advance above its present 6½ per cent.; optimism goes so far, indeed, as to prophesy that the next change will be in the downward direction, owing to the easier state of affairs that prevails in New York money. Most of the foreign exchanges—that of France being a notable exception—are nearly normal so far as our own country is concerned. This factor in itself has a soothing effect upon fears that were previously rife with respect to the Bank of England rate.

Home Railway Affairs.

The Home Railway market has gone ahead in lively fashion. The general tendency is more hopeful than it has been for a long time past, and various favourable elements in the situation are being allowed to have free play. The 2½ per cent. reduction in wages that was made last year is to continue in force for another six months, unless the provisional agreement, reached by the railways and three of the principal railway unions, should be upset by the irreconcilables. The Southern Railway announces an ambitious programme of electrification, under which the direct current third-rail system is to be extended from London to Brighton and Worthing. The Southern Railway has electrified 748 miles of its system, included in which is the 14 miles on the main line from London to Brighton which finish at Purley. The other 37 miles to Brighton is now to be taken in hand, and the work is to be commenced, if possible, before the end of this year. The Southern Railway has already spent over ten million pounds on electrification, and, under the continuance of the company's policy, a further million and a half sterling is to be utilised for the same purpose. The work will be an important contribution to the unemployment problem, and it will, incidentally, provide large contracts for firms supplying the necessary equipment.

Improvements in Prices.

Underground incomes are two points higher, at 108, the £1 shares remaining at 22s. 6d. Metropolitans gained one, and Districts 10s., rising to 62 and 73, respectively. These improvements come on top of the useful advances made last week. About £20,000 is available of City and South London 4½ per cent. second debenture, at 91. This yields 5 per cent. on the money, allowing for inclusion of the current half-year's interest due on January 1st next. This is a full trustee stock, guaranteed as to principal and interest by H.M. Government. It is dated 1942/72 for repayment. Outside the trustee list, Metropolitan District 4½ per cent. preference stock, on offer as to £5,000 stock, at 79¾, pays £5 14s. per cent. on the money, dividends being due in February and August. This may be accounted an attractive investment.

Cables and Wireless.

Cables and Wireless B ordinary stock, the speculative issue of the trio in this company, rose to 60, and then fell to 57½, which leaves a point loss on the week. The 5½ per cent. preference stock rose still more sharply to 96, a gain of 3½, and held it. The 7½ per cent. A ordinary stock is 2½ better at 85. The preference stock has attracted buyers by reason of the security which it offers, combined with the good yield. Statisticians are engaged upon an endeavour to work out the amount of profit that should be available in respect of the current six months for the Cables and Wireless A stock, and they agree that 5 per cent. will probably be earned, an estimate that is in accordance with market anticipations reflected here on several recent occasions. Cables and Wireless published early this month—the figures were set out in the Electrical Review of October 4th—the proportions of assents received from proprietors of the Cable Companies' stocks and of Marconi shares. The assents in respect of the necessary amounts of Cables' stocks and shares had been received; but there is still, or was at that time, a small amount of consent still required from the Marconi shareholders in order to render the scheme operative in such manner as would enable the Merger to escape the £40,000 stamp duty on the transfer. It is obvious that some of the holders of Marconi £1 and the preference shares are standing out against the Merger proposal; a reminder this of the bitter feeling evoked by the impression that these particular classes of shares had been treated with less than justice in the distribution.

Marconi Marines.

Marconi Marines gave way from 2⅝ to 2¼ on the announcement of an interim dividend of 5 per cent. against the 7½ per cent. declared a year ago. This announcement was taken as a hint that the dividend for the full twelve months is not likely to exceed 12½ per cent., as against 15 per cent. paid for last year. On the fall, a little support was rendered, and the price recovered to 2½. Marconi Marines have an adventitious assistance to their price in the lurking hope that, one of these days, the company will be invited to join the

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Cables and Wireless merger on terms that will have to be, of course, satisfactory to the Marine shareholders, though nothing of this sort has been mooted officially. Canadian Marconis dipped to 30s. 6d. before rallying to 31s. 3d.

Northants and Folkestones.

Hopes and rumours of acquisitions in the realm of electricity supply are responsible for several advances in share values. Chief of these is a gain of 3s. 9d. in Northamptons, to 52s. For several months past, gossip has persisted that the company, from its geographical position, will naturally be taken over by the Greater London and Counties Trust, the American-British company of which Lord Birkenhead is chairman. Of recent weeks, not much has been heard of this report, and the price of the shares fell back to 46s. 6d. Now, the talk reviving, the price has abruptly recovered, demand coming into a market in which the floating supply of shares is never extensive. The total number of ordinary shares in issue is 547,500. Folkestones have firmed up to 65s. 6d. Isle of Thanet are 1s. better at £2, on the hopes, and hints, mentioned here several times The preference are unchanged at 26s.

Electricity Supply Shares.

Urban Electric Supply ordinary, while nominally unchanged at 38s. 3d., are a harder market actually, attention being directed to the shares by the declaration of a 3 per cent. dividend. This is the same rate as that of a year ago. The Greater London & Counties Trust controls Edmundson's Electricity Corporation, which, in its turn, holds a substantial interest in Urban shares. Edmundson's 7 per cent. preference are quoted at 24s., County of London ordinary are 6d. down at 54s., Clyde Valley ordinary rose to 37s. 6d., on buying orders from the North; Yorkshires are a little lower at 35s. 6d. City of London preference, at 22s. 6d., have recovered half their loss of last week, but the tendency amongst other preference shares has been towards slightly easier prices. British Power and Light are also the turn lower, at 15s. 3d.

Dollar Stocks.

Brazilian Tractions came into request from New York and Montreal. This revived the talk of the shares being exchanged for those of the American & Foreign Power Company. The ordinary shares at first gained 3½, but shed 3 points of the advance; the preference, after shedding 10, rallied to their last week's price of 240. The company announces the now usual quarterly dividend of 50 cents on the ordinary shares, payable on December 2nd. In view of the falls that have taken place in many other Brazilian issues, the rises in Tractions are noteworthy by contrast. Hydro-Electrics weakened to 71½. Insignificant falls have lowered Shawinigan Water to 103½, and Power Corporation of Canada to 120. Montreal Light & Power rose 3 to 170½, Canadian General common is 410. Calgary Power common 175. Pennsylvania Water & Power, at 101, is up 5. Consolidated Gas & Power of Baltimore remains at 135½. Mexican Light common is down to 110, a fall of 7½. Mexico Trams keep about 53. Puebla, at 20, are unaffected by a disappointing report, which shows a loss on last year's working.

Strength of Manufacturing Group.

Shares in the manufacturing group are well maintained. Henleys have risen 1/16 to 6 9/16. Callenders recovered to £4. British Insulated gained ⅛ at 4⅛. Crompton Parkinsons are 1s. 6d. higher at 1½. Siemens have obtained an important contract to make and lay an Anglo-Belgian cable; the price of the shares is unchanged at 28s. 9d. General Electrics keep steady at 2⅞. The company has received a contract from the Metropolitan-Cammell Carriage, Wagon and Finance Company which secured the order for equipment of the Buenos Aires Central Railway's new underground railway now in course of construction. Associated Electrical Industries lost 1/16 at 37s. 6d. It is stated that three of the big German "weak current" electric firms have decided to form a holding company, in which the International Telephone and Telegraph will be largely interested. The price of the shares in the latter has risen 10 points to 135. American Telegraph and Telephones are equally better, at 310. Stock being pressed for sale upon an unwilling market served to lower Anglo-American Telegraph 6 per cent. preferred to 98½.

Miscellaneous Matters.

Babcock & Wilcox at 62s. 6d. are ex-dividend. The iron and steel division is quiet; Vickers revolve narrowly around 8s. 9d. It is proposed to amalgamate the great steel undertakings of Bolckow Vaughan and Dorman Long. British Aluminium shares are weak at 47s. 6d. Imperial Chemical Industries announces an interim dividend of 3 per cent., and states that the results for 1929 will enable the previous year's dividend to be maintained. This is taken as a hint that the company will pay 8 per cent. on the ordinary shares, the price of which has drooped to 31s. 9d. Rubber shares are without interest. The proposals of certain Dutch interests to restrict production, are not regarded very seriously.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Approx. Dividend. 1927.	1928.	Price Oct. 15 1929.	Rise or fall	Yield p.c.
Bournemouth and Poole	1	15	15	63/3	—	4 15 0
Brompton Ordinary	1	8½	8½	26/-	—	6 7 8
Charing Cross Ordinary	1	8½	8½	26/6	—	6 5 8
do. do. 4½% Pref. ...	1	4½	4½	17/-	−6d.	5 6 0
Chelsea	1	8¾	8¾	25/-	—	6 12 0
City of London	1	10	10	32/-	—	4 7 6
do. do. 6% Pref.... ...	1	6	6	22/6	+6d.	5 6 8
Clyde Valley	1	8	8	37/6	+⅛	... ...
County of London	1	7	10	54/-	−6d.	3 14 1
do. do. 6% Pref.... ...	1	6	6	22/6	—	5 6 8
Edmundson's 7% Pref.	1	7	7	24/-	—	5 16 8
Elec. Supply Corporation	1	11	11	52/-	—	4 4 8
Kensington Ordinary	1	8	8	26/-	—	5 7 8
Lancs. Light and Power	1	7½	7½	28/-	—	5 7 9
London Electric	1	8½	9	27/6	—	5 1 10
Metropolitan	1	9	9	46/3	—	3 17 8
do. 4½% Pref.	1	4½	4½	17/-	−6d.	5 6 0
Midland Counties	1	6½	6½	33/6	—	3 17 7
Mid. Elec. Power	1	15	8	34/6xd	—	4 12 9
Newcastle-on-Tyne Ordinary ...	1	6	6	26/3	—	4 11 5
do. 7% Pref.	1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	10	6	6	11	—	5 9 1
North Met. Elec. 6% Pref.	1	6	6	21/6	—	5 11 8
St. James' and Pall Mall	1	8	8	26/6	—	5 5 8
Scottish Power	1	8	8	31/-	—	5 3 8
South London	1	8½	8½	26/6	—	5 5 8
Urban Ordinary	1	7	7	38/3	—	3 13 6
Westminster Ordinary	1	8½	8½	25/6	—	5 9 10
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	23/6	−3d.	6 7 8
Yorkshire Elec.	1	8		35/6	−6d.	4 10

Home Rails.

Central London Ord. Assented ...	Stock	4	4	71	—	5 13 8
Metropolitan	"	3	3½	62	+1	5 13 0
do. District	"	4	5	73	+½	6 17 0
Underground Electric	£1	5	7	22/6	—	6 4 5
do. do. Income ...	Bonds	6	6	108	+2	5 11 1

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	98½	−2½	5 1 10
do. Def.	"	1½	1½	24⅜	—	6 4 5
Automatic Telephone	1	10	12½	37/6	—	6 13 4
Cables & Wireless 5% Pref.	Stock	—	—	86	+3½	5 14 7
do. A 7½ Ord.	"	—	—	85	+2½	... ...
do. B Ord.	"	—	—	57½	−1	... ...
Globe Tel. and T. Ord.	10	10	10	24	−1	*4 3 4
do. do. Pref.	10	6	6	10⅝	—	5 9 1
Great Northern Tel.	10	20	17½	80½	—	5 14 9
Indo-European	25	10	10	47½	—	*5 5 8
Marconi-Marine	1	12½	15	2⅜	−⅛	... ...
Oriental Telephone Ord	1	12	12	21⅝	—	... ...

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5⅝	8⅞	—	8 19 6
do. do. 2nd Pref. ...	5	6	6	8⅞	—	9 16 0
do. do. 5% Deb. ...	Stock	5	5	75	—	6 13 4
British Electric Traction Def. Ord.	"	5	5	1600	—	... ...
do. do. Pref. Ord.	"	8	8	124½	+2	6 8 6
Brazil Traction	100	7	8	72½	+½	9 15 9
Brit. Columbia Elec. Rly. Pcc. ...	Stock	5	5	66⅝	—	5 15 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	10/6	—	... ...
London United Tram Deb. ...	Stock	4	4	51⅛	—	7 15 4
Mexico Trams, 5% Bonds	—	5	5	73½	−8	6 18 0
Mexican Light Common	100	Nil	Nil	110	−7½	... ...
do. 7% Pref.	100	7	7	80½	—	8 8 8
do. 1st Bonds	—	5	5	78	—	6 12 5
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...

Manufacturing Companies.

Assoc. Elec. Ord.	1	6	—	17/	—⅛	3 4
Babcock & Wilcox	1	18	15	62/6xd	—⅛	*4 16
British Aluminium Ord.	1	10	10	47/6	—⅛	*4 4
British Elec. Transformer Pref. ...	1	7	7	13/-	—⅛	... ...
British Insulated Ord.	1	15	15	4⅛	+⅛	3 12 1
Brush Ord.	Stock	10	10	130	—	7 13 1
Callenders	1	15	15	4	+⅛	3 15
do. 6½% Pref.	1	6½	6½	1⅛	—	5 4
Crompton Parkinson Ord.	5/-	—	20	22/6	+1/6	6 13
do. 8% Pref.	1	8	8	25/-	—	6 8
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	7 1
do. 5% Deb.	Stock	5	5	84½	—	5 18
Electric Construction	1	7½	5½	15/-	—	7 6
Enfield Cable Ord.	1	20	20	5	—	4 0
English Electric	1	Nil	Nil	8/3	—	...
do. do. Pref. ...	1	8	Nil	8/9	—	...
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8
do. Ord.	1	10	10	28	—	3 16
Henley	1	25	30	6⅞	+⅛	4 11
do. 4½% Pref.	5	4½	4½	4¼	—	5 6
India-Rubber	1	Nil	Nil	12/6	—	... ...
Johnson & Phillips	1	10	—	2	—	5 0
Siemens Ord.	1	7½	7½	28/9	—	5 4
Telegraph Construction	1½	10	10	23	—	5 4

* Dividends paid free of Income Tax.

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Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1928.

7,304. "Low-frequency and high-frequency automatic telephone systems." J. J. V. Armstrong (Telefunken Ges. fur Drahtlose Telegraphie). March 9th, 1928. (319,193.)

9,334. "Resistance-coupled amplifiers." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). March 19th, 1928. (319,375.)

11,219. "Asynchronous motors." Naamlooze Vennootschap Hengelosche Electrische en Mechanische Apparatenfabriek and H. A. W. Klinkhamer. March 5th, 1928. (Addition to 294,563.) (307,329.)

11,669. "Electric relays." General Electric Co., Ltd., and W. Wilson. April 20th, 1928. (319,292.)

14,394. "Reproduction of sounds accompanying motion pictures." H. A. Whitehorn. May 16th, 1928. (319,197.)

14,502. "Electric batteries." Dr. M. Wildeman. May 17th, 1928. (319,198.)

17,041. "Sound-amplifying constructions and the like." H. Friedlander. June 12th, 1928. (319,199.)

17,245. "Process for preventing the occurrence of excess voltages in electrolytic cells for the electrolysis of water." A. Vogel. June 14th, 1927. (292,131.)

17,491. "Electric accumulator plates." H. G. Brown and D.P. Battery Co., Ltd. June 16th, 1928. (319,388.)

17,579. "Three-phase induction motors." M. Surjaninoff. June 18th, 1927. (292,476.)

17,589. "Devices for causing the intermittent illumination of a surface." British Thomson-Houston Co., Ltd., S. F. Davies, L. J. Davies, and H. W. H. Warren. June 18th, 1928. (319,389.)

17,594. "Electric radiator." F. D. Pitt. June 18th, 1928. (319,297.)

17,623. "Vacuum-tube oscillator circuits." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories, Inc.). June 18th, 1928. (319,259.)

17,646. "Electric fuses and bus-bar and circuit connections therefor, specially applicable to distribution fuseboards and the like." C. W. Cox and C. E. C. Shawfield. June 19th, 1928. (319,260.)

17,723. "Electric heating apparatus for heating bituminous or other materials." J. A. Reavell. June 19th, 1928. (319,298.)

17,724. "Electric heating apparatus for heating bituminous or other materials." J. A. Reavell. June 19th, 1928. (319,391.)

17,915. "Television apparatus and the like." J. L. Baird and Television, Ltd. June 20th, 1928. (319,304.)

17,934. "Mercury-arc rectifiers." British Thomson-Houston Co., Ltd., and F. P. Whitaker. June 20th, 1928. (319,305.)

17,935. "Mercury-arc rectifiers." British Thomson-Houston Co., Ltd., and F. P. Whitaker. June 20th, 1928. (319,306.)

18,005. "Electric storage batteries or accumulators." A. N. Hazlehurst. June 21st, 1928. (319,400.)

18,017. "Mercury-arc rectifiers." British Thomson-Houston Co., Ltd., and J. C. Read. June 21st, 1928. (319,401.)

18,535. "Direction-finding radio receivers." Igranic Electric Co., Ltd., and D. Sinclair. June 26th, 1928. (319,418.)

18,536. "Protective gear for alternating-current electric systems." J. H. Buchanan and Associated Electrical Industries, Ltd. June 26th, 1928. (319,419.)

18,612. "Method of controlling variable electric condensers and like apparatus." B. Hesketh. June 26th. 1928. (319,421.)

18,871. "Prepayment devices for use in connection with electric meters." C. E. Fry. June 29th, 1928. (319,423.)

19,030. "Electromagnetic reproducers for use with gramophone and the like records." Oliver Pell Control, Ltd., and C. Oliver. June 30th, 1928. (319,425.)

19,425. "Motor-generator control for electric winches and the like." W. H. Scott, G. J. Scott, and H. D. Wheeler. July 4th, 1928. (319,429.)

19,557. "Electric motor control systems." W. T. Gray and Associated Electrical Industries, Ltd. July 5th, 1928. (319,431.)

22,461. "Apparatus for television and like purposes." P. J. De Wet. August 2nd, 1928. (319,454.)

22,522. "Apparatus for reproducing, recording, or amplifying sound." T. Watson and R. E. L. Owen. August 3rd, 1928. (319,455.)

22,543. "Electric control systems and apparatus therefor." British Thomson-Houston Co., Ltd. August 5th, 1927. (295,045.)

22,554. "Electromagnetic reproducers for use with gramophone and the like records." Oliver Pell Control, Ltd., and C. Oliver. August 3rd, 1928. (319,456.)

22,809. "Electric regulators." British Thomson-Houston Co., Ltd. August 31st, 1927. (296,402.)

23,532. "Anti-vibration wireless valve holders." A. Preen. August 7th, 1928. (319,458.)

23,219. "Automatic control equipments for electric motors." British Thomson-Houston Co., Ltd. August 15th, 1927. (295,636.)

23,405. "Supply of current to thermionic valves for wireless apparatus and the like." A. Levy and M. Levy (trading as Soc. Electro-Technique Appliquée). August 14th, 1928. (319,463.)

25,584. "Secondary electric cells." A. Sismanopol. September 10th, 1927. (296,990.)

25,956. "Cooling of dynamo-electric machines." Siemens-Schuckertwerke Akt. Ges., and M. Dieterlen. September 10th, 1928. (319,479.)

27,019. "Electrodes for electric arc welding or soldering." Alloy Welding Processes, Ltd., and E. J. Clarke. September 20th, 1928. (319,487.)

27,362. "Wireless receiving sets." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). September 24th, 1928. (319,491.)

27,493. "Condenser microphones." British Thomson-Houston Co., Ltd. June 18th, 1928. (313,870.)

27,619. "Electrical insulation." I. G. Farbenindustrie Akt. Ges. September 26th, 1927. (297,749.)

27,637. "Thermionic valves." Marconi's Wireless Telegraph Co., Ltd. September 27th, 1927. (297,775.)

28,342. "Electric reciprocating mechanism or motors." R. C. Graseby. October 3rd, 1928. (319,502.)

28,575. "Distribution board, switch, or fuse-box installations for electric supply systems." H. B. Prentice. October 5th, 1928. (319,504.)

29,469. "Arrangement for preventing the corona on the slot-sleeves of high-tension electric machines." Siemens-Schuckertwerke Akt. Ges. October 13th, 1927. (298,645.)

29,870. "Electric switch for operating the light and sound signals of motor-driven vehicles." L. Siegl. October 22nd, 1927. (299,308.)

30,320. "Adjustable mountings for supporting lighting units, electric fans, or the like." Associated Electrical Industries, Ltd. October 20th, 1927. (300,063.)

31,014. "Means for picking up submarine cable." H. V. Higgitt and Eastern Telegraph Co., Ltd. October 25th, 1928. (319,527.)

32,017. "Electron discharge devices." International General Electric Co., Inc. November 2nd, 1927. (299,857.)

34,448. "Electrical timepieces." F. Marti. November 23rd, 1927. (301,040.)

34,536. "Electric condenser." S. Ruben. May 15th, 1928. (311,727.)

34,720. "Incandescent lamps of the multi-filament type." S. Hermont. April 27th, 1928. (301,319.)

34,944. "Impulse senders of the finger-disk type." Telefonaktiebolaget L. M. Ericsson. November 29th, 1927. (301,424.)

36,354. "Voltage regulators." Associated Electrical Industries, Ltd. December 9th, 1927. (302,163.)

36,462. "Photo-electric cells." E. G. O. Pressler, A. E. Pressler, and K. E. H. Pressler (trading as Pressler Thuringer Vakuumrohrenfabrik und Fabrik Wissenschaftlicher Apparate O.). December 9th, 1927. (302,183.)

36,688. "Speed-controlling means for alternating-current motors." International General Electric Co., Inc. December 12th, 1927. (302,247.)

37,830. "Electrically-driven colour-spraying apparatus." F. R. Dietrich. December 22nd, 1927. (302,930.)

1929.

106. "Ignition coils for battery ignition apparatus." Scintilla Akt. Ges. August 9th, 1928. (317,034.)

189. "Electric hand lamps." J. Neu and J. Neuberger (trading as Enn-Werke Neu & Neuberger) and C. Flamm. January 2nd, 1929. (319,556.)

1,044. "Electromotive driving means for gas compressors." C. Baumnn. March 16th, 1928. (307,907.)

3,501. "Apparatus for electrically measuring fluid flow." H. Martin. August 13th, 1928. (Divided application on 306,014.) (319,570.)

6,563. "Instruments for measuring electric resistances." F. Bozek. February 28th, 1929. (319,578.)

12,036. "Television apparatus and the like." J. L. Baird and Television, Ltd. June 20th, 1928. (Divided application on 319,304.) (319,307.)

16,081. "Windings for dynamo-electric machines." International General Electric Co., Inc. May 25th, 1928. (312,364.)

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from October 9th :—

Demon. No. 502,867. Class 6. Electric vacuum cleaners. Tornado. No. 500,356. Class 13. Electric incandescent lamps (ordinary).—L. Benn & Co., Ltd., 8, Colonial Avenue, Minories, E.C.1.

Ranger (lettering and design). No. 502,107. Class 8. Electrical dry cells (not for medical purposes).—J. F. Smith (Birmingham), Ltd., 92, Hirst Street, Birmingham.

Jumbo (lettering and design). No. 502,597. Class 8. Radio-telephonic and telegraphic apparatus and parts thereof.—Parlophone Co., Ltd., 1, Broad Street Buildings, E.C.2.

Panophase. No. 502,301. Class 8. Electrically-operated sound reproducing instruments and radio-telephonic and telegraphic apparatus.—E. J. Allan, trading as the Radio and Electro-Acoustic Development Co., 8, Westfield Place, Dundee.

Junilog. No. 505,775. Class 8. Electric condensers for use in radio-telephony and telegraphy.—Sydney S. Bird, Cyldon Works, Sarsefield Road, Enfield Town.

Egarsal. No. 505,034. Class 13. Lamps (ordinary) and reflectors.—Glareless Reflector Co., Sydney, N.S.W. (British representatives: Dicker, Pollak and Mercer, 20-23, Holborn, E.C.1.)

Premag. No. 505,396. Class 13. Filler rods and electrodes for use in electric arc and acetylene welding.—Premier Electric Welding Co., Ltd., Abbey Wood, S.E.2.

Forthcoming Events.

British Electrical Development Association.—Friday, October 18th. Royal Society of Arts, John Street, Adelphi, W.C. 7.30 p.m. "Personal Salesmanship in the Electrical Industry." Miss G. Burlton.

Birmingham Electric Club.—Friday, October 18th. Grand Hotel. 7 p.m. Ladies' night.

Friday, October 25th. "Motor Users and the Frequency Change." Mr. T. A. Windebank.

Electrical Power Engineers' Association (Southern Division).—Saturday, October 19th. Hotel Cecil, Strand, W.C.2. Annual dinner.

(London Technical Group).—Tuesday, October 22nd. Lighting Service Bureau, Savoy Street, W.C. 7.15 p.m. "Modern Developments in the Electric Lighting of Public Thoroughfares."

(Manchester Local Technical Group).—Wednesday, October 23rd. "Main Transmission Systems of the Central Electricity Board." Mr. J. D. Peattie.

Edinburgh Electrical Society.—Wednesday, October 23rd. 16, Royal Terrace, Edinburgh. "Electric Plant Repairs." Mr. J. Walker.

Institution of Electrical Engineers.—Thursday, October 24th. Institution, London, W.C. 6 p.m. Presidential address by Col. Sir T. F. Purves, O.B.E.

(Mersey and North Wales (Liverpool) Centre).—Monday, October 21st. The University, Liverpool. Address by the chairman, Professor E. W. Marchant.

(North-Western Centre).—Tuesday, October 22nd. Engineers' Club, Manchester. Address by the chairman, Mr. T. E. Herbert.

(North-Eastern Centre).—Monday, October 21st. Armstrong College, 7 p.m. Address by the Chairman, Mr. B. A. Robinson.

(North-Eastern Students' Section).—Friday, October 25th. Armstrong College, Newcastle-on-Tyne. 7.15 p.m. Address on the Work of the Electrical Development Association.

Junior Institution of Engineers.—Friday, October 25th. "Electric Welding as applied to Bridges and other Structures on the L. & N.E. Railway." Mr. H. Bruff.

Physical Society.—Friday, October 25th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

Faraday House Old Students' Association.—Friday, October 25th. Savoy Hotel, London, W.C. 6.30 for 7 p.m. Annual dinner.

Iustitution of Railway Signal Engineers.—Friday, October 25th. Criterion Restaurant, London, W. Annual dinner.

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

AYR.—School, Heathfield, with electrical work, for Ayrshire E.C.; W. Reid, Education Offices, Ayr.

BEXHILL-ON-SEA.—Church, with electrical and heating work; J. B. Mendham, architect, London; Pool and Sons, builders, Hartley Wintney, Hants.

BLACKPOOL.—Ice skating rink (£150,000), for the Blackpool Ice Skating Syndicate, Ltd.; secretary.

BRADFORD.—Reinstatement of five-storey warehouse; Illingworth, Wood & Co., Ltd., Mumby Street, Fairweather Green.

BRISTOL.—Houses (144), Shirehampton estate; city engineer.

BURNLEY.—Housing scheme (48), Royds estate; borough surveyor.

BURTON-ON-TRENT.—Houses (130), Horninglow Road; Aerodrome; borough engineer.

CARDIFF.—Secondary school, North Road and New Zealand Road (£42,136); W. S. Eglen.

CHESTERFIELD.—Elementary school, Boythorpe (£16,000); Swift Bros. & Haslam, Ltd., Doncaster.

COLLYHURST.—Additions to paper works, Irkdale Street, for J. Hargreaves, Ltd., Collyhurst Mills; A. Brocklehurst & Co., 10, Norfolk Street, Manchester.

COSHAM.—Children's homes at Peaked Field (£30,503); Bevis, Ltd., Portsmouth.

DARTON.—School (£20,000), for West Riding E.C.; director of education, Wakefield.

DONCASTER.—Additional 176 houses, Intake estate, and public baths, St. James' Street, for the T.C.; borough surveyor. Central school, for the borough E.C.; Athron & Dyson, architects.

DORCHESTER.—Girls' grammar school (£16,244), for Dorset E.C.; Messrs. Druitt, builders, Bournemouth.

DOUGLAS (Isle of Man).—Cinema, Buxton's site, Central Promenade; W. H. Lomas. Alterations, Strand Cinema; Strand Theatre Co., Ltd.

DUKINFIELD.—Senior girls' school, for the borough E.C.; director of education.

DUNDEE.—Central school, for education authority; Allan and Friskin, architects, 26, Castle Street.

EASTBOURNE.—Additions, Imperial Hotel, Devonshire Place; G. Bainbridge & Son. Swimming baths, The Redoubt; borough engineer.

EDINBURGH.—Industrial hall, for Corporation (£200,000); city architect.

FLAXTON.—Estate development, Tang Hall Lane; H. L. Swift.

GLASGOW.—Buildings, Houldsworth Homœpathic Hospital (£25,000); the medical superintendent. Hall, for trustees of Mosspark branch of the I.L.P.; the secretary. Baths, Carthcart; city engineer.

HARWORTH.—Cinema (1,000 seats); Medcalfe Bros., builders, Doncaster.

HOUNSLOW.—Houses (126), for the Heston and Isleworth U.D.C.; Blackwell and Meyer, builders, Bexley Heath.

HULL.—Houses, Barnsley Street (24), Southcoates Lane (72), and Madeley Street (54); city engineer. Alterations, National and Monica picture theatres; licensees.

IRISH FREE STATE (Donabate, Co. Dublin).—Electric lighting at Ballymastone Farm, Portrane Mental Hospital; chief clerk, Grangegorman Mental Hospital, Dublin.

(Dublin).—National Gallery; city architect.

KIDDERMINSTER.—Housing scheme (118), Sutton Farm, for the T.C.; J. Hawcroft, borough engineer (returnable deposit of £2 2s.).

LEEDS.—Baths and wash-house, Car Croft, Armley, for the City Property Committee (£58,027); L. Harpham, building contractor.

LINCOLN.—Additional 50 houses, for the T.C.; city surveyor.

LINGFIELD.—Central school, for Surrey E.C.; W. W. Finny, secretary, Kingston-on-Thames.

LINLITHGOW.—Cinema, tea rooms, and dance hall (£25,000); secretary of syndicate, c/o burgh surveyor.

LUTON.—Arcade of shops, Moor Street, for T. Harbut.

LONDON (Stepney, E.).—Reconstruction of premises, 18-26, Causeway (£50,000), for Dr. Barnardo's Homes.

(Westminster, S.W.).—Building scheme at corner of Wardour Street and Edward Street; R. C. Campbell, 5, Cork Street, W. Tenements, Grosvenor estate; Sir Edwin Lutyens, architect. Leicester Square Theatre, St. Martin's Street and Leicester Square; A. Mather. Alterations to Cleveland Street annexe, Middlesex Hospital; Young & Hall, architects.

MANCHESTER.—School, Levenshulme; rector, St. Robert's R.C. Church. Hotel, Kingsway and Moseley Road, for Groves & Whitnall, Ltd., Salford (£25,000); Graves and Ellerton, 80, Mosley Street. Baths and washhouses, Ardwick, Collyhurst, Abbey Hey and Clayton; city architect, Town Hall. Extension of the Babies' Hospital, Cringle Hall, Burnage (£40,000); clerk to the governors. Bank and offices, Kingsway, Burnage, for Manchester and Salford Savings Bank; H. Hankinson, 2, Ashby Road, Altrincham.

MORETON (Birkenhead).—School, with heating and lighting work (£6,123); Humphreys, Ltd., contractors.

MOTHERWELL.—Reconstruction of engineering works, for John Black, Ltd.; the manager.

PLYMOUTH.—Houses (57), North Prospect estate. Baths, hall, and winter gardens, West Hoe (£196,000); city engineer. Garage, Laira Bridge Road; Western National Omnibus Co. Reconstruction, factory, Martin Street; J. Common & Son.

PORTSMOUTH.—Aerodrome, Highgrove Farm. Abattoir, East Wymering; city engineer. Bakery and dairy depôts, High Street, Cosham; Portsea Island Co-operative Society, Ltd.

PRESTON.—Sewage disposal scheme, with pumping station and plant, for the T.C.; Mr. Platt, borough surveyor.

PURFLEET (Essex).—Additional 80 houses, for the U.D.C.; surveyor.

READING.—Houses (2,000), shops (20), &c., at Whitley Park estate, for T.C.; housing architect.. School, Wardle Avenue; Ruffell Bros.

REIGATE.—Police and fire station and public baths (£26,650), for the T.C.; Burnand & Pickett, Ltd., builders, Wallington.

RIBBLETON (Preston).—Silk works, for Courtaulds, Ltd., Bocking, Essex.

ROCHDALE.—Housing scheme (104), Spotland estate; S. H. Morgan, borough surveyor.

ROTHERHAM.—Houses (400), Herringthorpe estate. Shops and offices, Effingham Road; borough engineer. Extensions, mills, Sheffield Road; United Strip and Bar Mills, Ltd.

ST. HELENS (Lancs.).—Houses (34), Graham Street and Ardwick Street, for J. Gleave & Sons. Business premises Church Street and Naylor Street, for F. W. Woolworth and Co., Ltd., London.

SALFORD.—New wing, Hope Hospital (£75,000), for the Board of Guardians; Mr. Hill, architect.

SHEFFIELD.—Institution for the blind; Sheffield and Rotherham Corporations.

SILKSTONE COMMON.—Electric lighting installation school, for West Riding E.C.; J. H. Crabtree, Town Hall, Penistone.

SOUTHPORT.—Motor-'bus garage, Canning Road (deposit £1 1s.); A. E. Jackson, borough engineer, Town Hall.

STAINES.—Additional 94 houses, for the U.D.C.; Blackwell and Meyer, builders, Bexley Heath.

STOURPORT.—Extensions, Severn Valley works, for T. I. Worth & Sons, Ltd.

STRETFORD.—School, Low Moss Lane (£14,000); secretary to the E.C.

TONBRIDGE.—Additional housing scheme (224), Hayesden estate, for the U.D.C.; housing architect.

TRURO.—Sewage works (£60,000); city engineer.

WALSALL.—Houses (175), Forest estate; Abraham Smith, Bloxwich.

WARMINSTER.—Central school, for Wilts. E.C.; director of education, Trowbridge.

YORK.—Houses, Burton Lane estate; H. Hibbert, Barnsley (111); Walter Blair, Rotherham (56). Mental institution; York Corporation and North and West Riding County Councils. Assembly hall, York College for Girls, Petergate; governors. Hall, Heworth; Heworth Conservative Association.

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NOV 2

The ELECTRICAL REVIEW

FOUNDED 1872

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The

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Electric Ship Propulsion.

ALTHOUGH much has been written in recent years on the subject of the application of electricity to the propulsion of ships and the advantages of this system in comparison with other systems of propulsion have been frequently set forth, it has not always been possible to quote actual operating figures—figures obtained when the vessel is running under commercial conditions at sea, as distinct from figures obtained on trial trips—in justification of the claims which have been made for the electric drive. We are, therefore, particularly pleased to welcome the paper entitled "Electric Propulsion as Applied to Passenger Liners" (an abstract of which appears elsewhere in this issue) which was presented by Mr. Eskil Berg to the Institute of Marine Engineers. Mr. Berg is the head of the marine contracts department of the American General Electric Co., which was responsible for the machinery of the two electrically-propelled passenger liners *California* and *Virgina*, which have recently been put into service between New York and San Francisco, *via* the Panama Canal. As, however, he was unable to make the journey to this country, the paper was read by Mr. W. J. Belsey, of the British Thomson-Houston Co., Ltd., which is closely associated with the American concern named, and, moreover, was responsible for the electrical equipment of the P. & O. liner *Viceroy of India*, a vessel which differs not very greatly either in size or equipment from the two American ships mentioned above.

The principal feature of Mr. Berg's paper was the valuable data he gave of the actual performance of the *Virginia* during the course of a service voyage from New York to San Francisco and back, a total distance of 10,870 nautical miles, which is obviously sufficiently great to eliminate the effect of any errors due to inaccuracy of measurement and to give a clear idea of the capabilities of the vessel and her equipment.

It may be of interest to note before commenting on the performance data included in the paper that the *Virginia* is a twin-screw vessel 613 ft. 1¼ in. in length

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and of 32,800 tons displacement, having machinery of 17,000 shaft-horse-power, which is capable of giving her a speed of 18 knots. Two turbine driven alternators, each having a rating of 6,600 kW at 2,880 r.p.m., generate three-phase current at a pressure of 4,000 volts. There are two synchronous induction-type motors, one directly connected to each propeller shaft, each motor having a normal rating of 8,500 horse-power at a speed of 120 r.p.m. When it is desired to run the vessel at cruising speed, *i.e.*, in the vicinity of 15½ knots, only one generator is required, the power required being nevertheless developed at maximum efficiency. Steam for driving the turbines is obtained from eight oil-fired water-tube boilers of the Babcock and Wilcox type, having a working pressure of 275 lb. per sq. in., the steam being superheated 200 deg. F. above saturation temperature. Under these conditions, with a vacuum of 28½ in., the steam consumption at full power works out at 8.1 lb. of steam per shaft-horse-power-hour, which is equivalent to 10.85 lb. per kW-hour, a very good performance when it is remembered that this figure includes all the auxiliary load, and that the power required for operating the refrigerating plant alone is about 800 h.p. The fuel-oil consumption is equally impressive, the run from New York to Havana showing a consumption of 0.715 lb. per s.h.p.-hour for all purposes. This is equivalent to 0.96 lb. per kW-hour, or, assuming a calorific value of 18,500 B.th.u. per lb., is the same as a coal consumption of 1.42 lb. per kW-hour, the coal having a calorific value of 12,500 B.th.u. per lb.

Apart from the actual performance data, Mr. Berg summarises the advantages of the electric drive in the light of the experience gained by the running of the *Virginia* and her sister ship. They need not be referred to in detail here, although emphasis may be put on the absence of vibration and noise, a valuable feature which has also characterised the *Viceroy of India*, and is in strong contrast to the well-known state of affairs on certain passenger vessels fitted with other forms of propelling machinery. Attention may also be drawn to the fact that the amount of boiler feed make-up water required on electric ships is less than one quarter of that on any other type of similar steamer. This striking result, which represents a considerable saving on the uneconomic deadweight which a vessel must carry, was widely commented upon during the course of the discussion which followed the reading of the paper, certain speakers venturing to question the accuracy of the figure given. In the absence of any definite data we need not venture an exact opinion, but that a considerable saving is effected in make-up water is certain.

Finally, in the light of the above advantages Mr. Berg makes a comparison between the performance of the *Virginia* and that of a Diesel engine driven ship of approximately the same size and speed. As regards fuel consumption, the advantage is, of course, with the latter vessel, but when the relative costs of fuel oil and Diesel oil are considered (the latter costing twice as much as the former in New York, although in this country, it should be observed, the relative costs are as five is to four) the balance is in favour of the electrically-propelled vessel. The comparison with the geared turbine vessel *Bremen* is vitiated by the fact that the two ships differ very greatly as regards size and power and speed, although it is of interest to speculate on the possibilities of a holder of the blue-ribbon of the Atlantic propelled by electrical machinery. But even while every allowance may be made for the enthusiasm which Mr. Berg evinces for the electric drive, there can be no doubt that it has shown in practice that it possesses many marked advantages over the direct Diesel drive or the geared turbine drive, particularly for the propulsion of passenger liners. We have already commented favourably on the foresight shown by the directors of the P. & O. Co. in their choice of the electric drive for the *Viceroy of India*, and whilst awaiting performance data for this vessel—which, it is to be hoped, will soon be forthcoming—we may commend Mr. Eskil Berg's paper to shipowners who are contemplating the construction of new tonnage.

Mr. Marryat's Appeal for the Benevolent Fund.

The Electrical Trades Benevolent Institution has had a very warm place in our heart ever since it was formed. There is no more deserving fund in the electrical industry—its existence has enabled a helping hand to be held out just in a nick of time in hundreds of cases of distress; men and women have been relieved in the midst of the greatest anxieties that life can bring. But the actual need, even in this great industry of ours, is greater than can be met from the accumulated funds; surely nobody requires to be told to-day how painfully hard some of the cases are. The E.T.B.I. has been fortunate in the succession of presidents who have readily espoused the cause and issued strong appeals for funds. Mr. H. Marryat, M.I.E.E., whom we welcome as the latest of the splendid line of enthusiastic presidents, is eager to do a noble part by raising sufficient new capital to put the Fund on so solid a basis that it may be possible to grant pensions in cases in which totally incapacitated claimants already on the books, drawing small temporary relief which is renewed from time to time, shall receive a small pension enabling them to spend their remaining days in comfort in the country. To do this, he appeals in our "Correspondence" columns to-day for ten donors of £500, each to take up a vacant Vice-Presidency, 50 of £100, each to become a Life Governor, and others to subscribe £10 for life membership. By means of these and a generous addition to the general subscription list, Mr. Marryat would like the present capital fund to be advanced from £37,000 to £50,000. As he points out, claims are increasing every day. The industry, however, is growing rapidly too, and we earnestly direct attention to the president's appeal, commending it to the immediate practical interest and sympathy of everybody electrical.

It will be noted that, in the foregoing, stress is laid on the need for comparatively large donations, as it is by that means that the granting of pensions, so long the Fund's aspiration, may at last become a practical achievement. But if this matter appears in the forefront at the moment, it must not be supposed that the E.T.B.I. president and Executive have any less regard than usual for the smaller subscriptions and donations which we trust are in course of enthusiastic collection everywhere just now. Let the Marryat year be a memorable one!

Generation of Electricity in 1928-29.

As mentioned by us last week, the Electricity Commissioners have published their annual analyses and summaries of the returns of fuel consumption and kWh generated for the year ended March 31st, 1929; they are reviewed elsewhere in this issue.

The returns relate to 564 stations, including ten newly put into commission, and cover not only authorised undertakings but also railways, tramways, and certain non-statutory concerns. These stations generated 10,978,980,925 kWh (about 30 per cent. of which was accounted for in the London and Home Counties), an advance of 9.58 per cent. on the previous year, but the fuel consumed increased by only 3.66 per cent. In the period under review, 27 stations were permanently closed down.

The proportion of the total output produced by steam was 95.39 per cent., with an average fuel consumption per kWh of 2.05 lb. as against 2.16 lb. in the previous twelve months. The fuel consumption for all stations, converted where necessary to a coal basis, was reduced to 2.16 from 2.24 lb. per kWh. The highest thermal efficiency was, as might be expected, obtained by an oil-engine station, Lewes, with the figure of 28.89 per cent. for an output of something less than a million kWh, though this station was beaten by Buxton, also an oil-engine station, on the amount of fuel used (0.61 lb. per kWh). For steam stations the best results, both in thermal efficiency and lb. of coal per kWh, were secured by Padiham, 21.35 per cent. and 1.33 lb., respectively. Second in thermal efficiency was Barton (21.31 per cent. and 1.37 lb.), but North Tees in fuel consumption (21.19 per cent. and 1.35 lb.). Three other stations also

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obtained thermal efficiencies exceeding 20 per cent., *viz.*, Ferrybridge, Barking, and Hartshead (Stalybridge). The load factors of these stations varied between 40.4 per cent. (Barking) and 50.5 per cent. (Ferrybridge). Barking had the greatest output of any station, approximately 400 million kWh.

In Table VI, the stations are grouped according to output; 11 stations generating about 20 per cent. of the total come under Class A and have an average fuel consumption of 1.73 lb. per kWh. There is a progressive increase in fuel consumption per kWh as the output decreases, with one exception in the smallest stations.

Perhaps the most notable feature of these returns is the occupation of the premier position by Padiham with an m.d. of 18,000 kW and an output of some 67 million kWh. This station was designed upon lines that might be considered old-fashioned, as it is without many of the aids to high thermal efficiency adopted in the case of the most modern stations. This is not to imply a doubt as to the efficacy of recent trends in power station design, but rather to give all the greater credit to the operating staff of the Lancashire Power Co.

Brighter Post Offices.

In the Electrical Review of February 1st, 1929, we ventured to offer criticism of the bad exterior lighting of the General Post Office—the entrance and exit steps and the posting boxes. We expressed regret that some of our biggest public buildings were still living in the dark ages. Anybody passing along King Edward Street in the early evening nowadays can see for himself the justice of our criticism. We had wondered whether we ought to entertain hopes of early improvement as it sometimes takes a long time in Government Departments to get official consent to alterations duly drawn up and authoritatively signed, sealed, and delivered to the executive parties, so that the work may be done. Possibly this particular matter is actually passing through these stages as we write. That something is happening " at the top " is obvious from the report that reached us on the wireless the other evening. Mr. Lees Smith, the Postmaster-General, was reported to have stated that a scheme for brightening Post Offices in all parts of the country was to be proceeded with. Incidentally, it would create employment. We welcome his pronouncement with enthusiasm, for better illumination is required in so many places, central and suburban, and above all we can hardly imagine that he will overlook the poor " General."

Competition for Electrical Contracts.

In these days when the importance of the South American market is being stressed so much, it is pleasing to hear of the success of a British concern in securing the important contract for the equipment of the new Buenos Aires underground railway. The psychological effect of this success should be of even greater benefit than the material results. It will be felt when many other schemes in South America are under consideration, for it has been shown that we can still meet Continental and American competition in that market which some would assert is turning away from us. The General Electric Co., Ltd., is to be congratulated upon securing an important part of the work, and we may assume that its strong local representation had a great deal to do with the company's success. Only a thorough understanding of the conditions, such an understanding as is secured by people " on the spot," can produce a scheme acceptable to those who have orders to place.

At about the same time as this contract was secured in the face of Continental and American tenderers, a New South Wales company was awarded a large order for batteries by a South African customer. *Reuter's* Agency reports that the Australian company was successful against keen English, German, and American competition.

This is an unusual instance, and we are not sure that any conclusions can be drawn from it, but it is interesting to place these two items side by side.

Skilled Labour in France.

We are informed that the supply of skilled labour in France continues to be insufficient to meet the industrial requirements, for in every important trade the demand is for more workmen. The shortage of capable solderers, winders, mechanics, and foundrymen, is particularly acute. In many districts these workmen have no difficulty in earning Fr. 50 to Fr. 60 per day of eight hours, or about 1s. to 1s. 3d. per hour. These rates, which are very high for France, are exceeded in many districts. Perhaps only in the case of casual labourers is the supply equal to the demand, for it is this class of worker which is deserting the country and flocking to the towns, to the great detriment of the most important French industry, the cultivation of the soil. It would certainly appear that the tendency is for France to become an industrial country, and this tendency is particularly apparent in the vast areas of agricultural land which, owing to the lack of suitable labour, have been abandoned. It is extraordinary that the situation in France from the standpoint of labour and labour supply should be so diametrically opposite to that which exists among her neighbours in England and Germany, but there is no doubt that the small population in France, in comparison with the size of the country, is largely responsible. At the present moment the French Government is passively allowing the immigration of skilled workmen, and during the first week of October the number of foreign workmen admitted amounted to 4,917. In view of our own economic and labour conditions this shortage of skilled workmen is of interest, particularly in view of the small distance that separates the two countries, but it may be observed that it is primarily essential for foreign workers in France to have at least an elementary knowledge of the language, if only for the sake of their own personal comfort. Unlike the Belgians, Italians, and Spaniards, of which nationalities there is a floating population in France of about a million representatives of each country, the British element is not sufficiently important to permit an Englishman to reside among his own countrymen.

Progress in Illumination.

The opening meeting of the 1929-30 session of the Illuminating Engineering Society was, as usual, devoted to a survey of progress made last season and exhibits illustrating improvements in illuminating engineering. The proceedings serve to show how the applications of artificial light are extending and how the movement is developing in other countries. With many of the inquiries noted therein members of the Society are associated, and it is closely linked with several other bodies which are conducting researches on illumination, such as the Illumination Research Committee, the National Illumination Committee, and the British Engineering Standards Association. Novel types of lighting fittings, stage-lighting equipment, and luminous traffic control signals figured amongst the exhibits. A particularly attractive item was the display of the " Kodacolour " film projector by Dr. Walter Clark.

After a successful year of office Mr. C. C. Paterson is retiring from the presidency, and the vacancy has been filled by Dr. J. W. T. Walsh. In the course of the proceedings it was announced that the Council had decided to form a Leon Gaster Memorial Fund, the interest on which will be applied mainly to the award of an annual premium for the best contribution furnished to the Society dealing with any aspect of illuminating engineering. We feel sure that no better method of preserving the memory of the founder of the Society could have been devised. No doubt the appeal will meet with a ready response from members, and it is probable that others of the many friends of the late Mr. Leon Gaster in the electrical industry may like to subscribe to the fund.

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Small Hydro-electric Schemes.

Guiding notes for those contemplating the use of water power for electricity generation for country houses, estates, and villages.

By M. I. WILLIAMS-ELLIS, A.M.I.E.E., A.M.I.Mech.E., M.S.A.I.E.

THE need for supplies of electricity in isolated localities has within recent years brought about the production of many novel pieces of apparatus, and has at the same time caused a large number of engineers, architects, mechanics, and householders to become closely associated with the equipments that have been elaborated to fulfil this want. In this connection it has often been noticed that small internal-combustion sets have been bought "off the shelf," without giving the natural resources of the district any consideration with

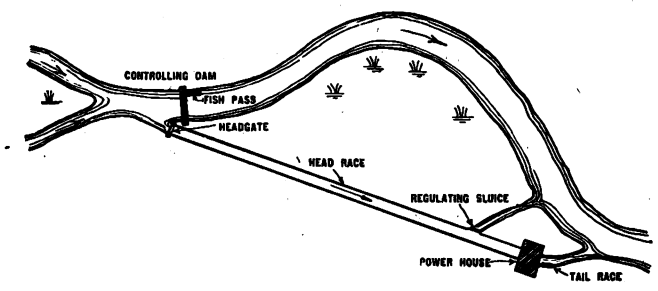

Fig. 1.—General Arrangement of Low-pressure Hydro-electric Scheme.

regard to the possibility of production of power from the small streams or ponds that may be available. In many cases this may be put down to the first capital cost, as there is little doubt in most cases that the cost of installing an oil-engine set as against a hydro-electric set is in favour of the former; but in any such oil-engine installation the case of the electric storage battery is a heavy item, not only in first cost, but also in repairs, renewals and attention.

Until recently water power offered comparatively little advantage in this respect over the oil engine, for, although the battery could generally be smaller, it was necessary to use one to maintain the steady voltage required for lighting; as, however, accurate and reliable governors have now been made applicable to small hydro-electric plant with very satisfactory results, batteries are no longer necessary. Guarantees are to-day given that the momentary rise of speed above the settled no-load speed, when the whole load is suddenly thrown off, will not exceed 2 per cent.

Too little consideration has, however, been given to the upkeep charges, running costs, and general depreciation, which are in favour of the hydro-electric scheme every time, provided the plant is, of course, of suitable construction and properly laid out, and on this a great deal depends. One may summarise the chief features of water power briefly as follows:—

(*a*) Low cost of maintenance is shown by the fact that a sinking fund of 2½ per cent. per annum of the capital value of the plant is an ample allowance to make for this charge.

(*b*) Simplicity is a great feature and, compared with any form of heat engine, the simplicity of construction of a water turbine, Pelton wheel, or an overshot water-wheel is most marked; there is no difficulty in starting, it can be accomplished in the majority of cases in a few seconds.

(*c*) The absence of a fuel bill is the greatest and most obvious advantage of water power; moreover, compared with other forms of prime movers, the lubricating oil and grease required for hydro-electric plant is very small.

(*d*) The labour required for ordinary water-power plant in out of the way districts is usually unskilled, and for small installations such as those under review the attendance required in many cases can be reduced to a visit every 24 hours; sets have been in operation for weeks without attendance, but this is not recommended.

As the conditions of water-power schemes vary so widely, the type of plant to be used has also to be varied. Neglecting the old type of water wheel, one may place the two classes used as distinct: (1) re-action turbines (Francis and axial types); (2) impulse turbines (Pelton and impulse types). The former are suitable for falls up to, say, 150 ft., *i.e.*, for low and medium falls, and the latter are suitable for falls of 150 ft. upwards, but may often be advantageously used for falls as low as 30 ft. when the power required is small. Generally speaking, the type of turbine to be used will be determined by the conditions at the site. For relatively low falls up to, say, 15 or 18 ft. on small-power turbines, the open (uncased) type of turbine will usually be the most economical. For large-power turbines the open type may be economically used with falls up to 30 ft., or sometimes even higher; but for medium or high falls a cased type of machine is essential. A typical general arrangement of a low-pressure scheme is shown in fig. 1. In all cases in which a medium or high fall is available, careful consideration should be given to the desirability of installing an impulse-type turbine.

One of the chief troubles met with by users of small water-power plant is the periodical clogging of the strainer plates at the time of the year when the stream or river is bringing down large quantities of leaves,

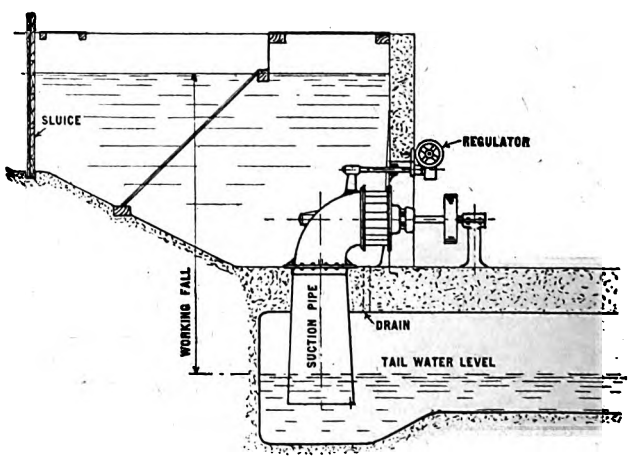

Fig. 2.—Horizontal Turbine with Right-angle Suction.

peat, sticks, &c., so that it often means cleaning the screens by hand. Messrs. Gilbert Gilkes & Co., Ltd., have placed upon the market a very simple device for the cleaning of screens by hydro-mechanical means, the mechanical portion being operated by a small water wheel or by an electric motor. The operation depends on the difference in level between upstream and downstream sides of the strainer plates, and the actual removal of the leaves, &c., from the strainer is effected by

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suction through a pipe or pipes operating on a pivot in front of the screen. When, owing to the accumulation of leaves on the strainers, the water on the upstream side

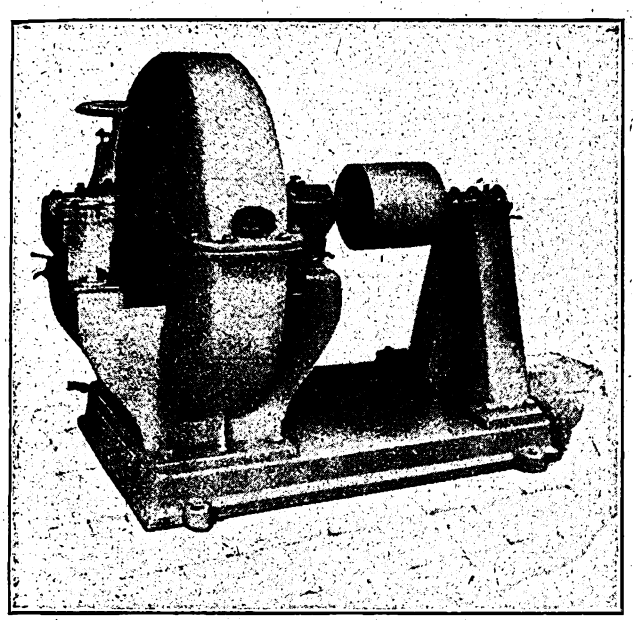

Fig. 3.—Pelton Wheel for Belt Drive.

is higher than that on the downstream side, the motor comes into operation, and the suction nozzles travel up and down over the strainer plates until the leaves, &c., have been removed. Equilibrium is then again established between the two sides of the strainers, and the motor automatically stops. The motor is stopped when the nozzles are in their "out of water" position, so that there is no unnecessary waste of water.

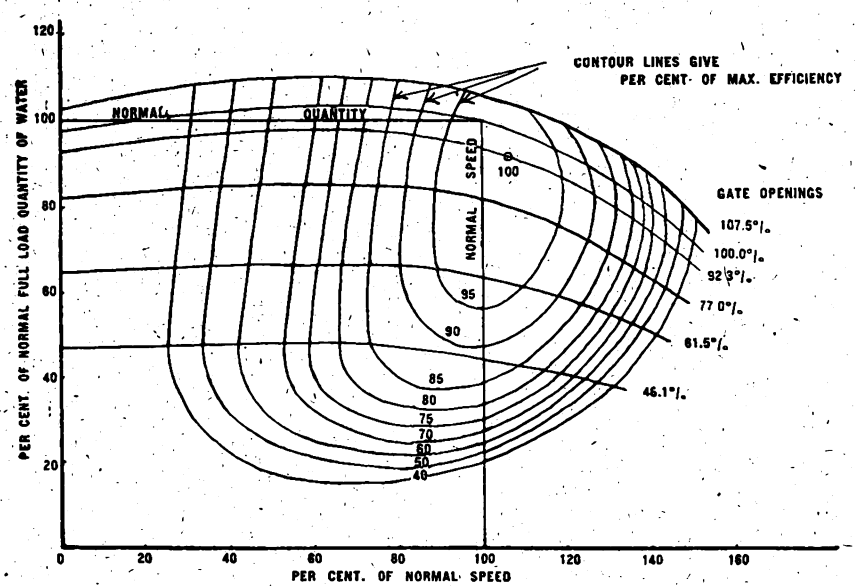

Fig. 4.—Characteristic of "Gilbert Gilkes" Francis Turbine.

The construction of dams in connection with even small water-power plant is all important, but much depends on the situation, and one can find cases in which the dam may cost, say, only £30 to construct, and others wherein the cost is as much as £300 to get the same power. It greatly depends on whether the water is impounded or not. In some cases small lakes or reservoirs have to be specially constructed to store the water, as the normal supply from the stream would not be enough for the usual requirements at any given time. There are other cases in which the supply all the year round from a stream is ample for the requirements, and in such cases it is only necessary to construct a small controlling dam across the stream, so as to divert the required amount of water along a pipe or flume. In the construction of dams, however small, great care should be given to the design, and to see that a proper foundation is obtained, and that naturally they are watertight, as a small leak might seriously affect the strength of the dam.

Such dams are usually built up of masonry and have concrete cores, or, as in the cases of many small lakes, they are sometimes of earth with a stone pitching and clay, peat or bitumen core, or, again, the lake side of the dam may be lined with a bitumen sheeting with a cement facing. Dams across streams have to be designed to allow for the full volume of water to pass in the case of heavy floods, without interfering with the normal supply to the turbines, while often special arrangements have to be made to allow fish to pass up the stream or river through or over the dam by means of fish ladders, &c.

In the case of river dams it is the writer's experience that it is most important to arrange for special sluices to be constructed at the bottoms of the dams to allow for the periodical washing out of silt, &c., which otherwise is liable to fill up to the top of the dam in time, possibly causing serious trouble to the turbines and loss of impounded water space, while in many cases it is necessary to allow for compensation water to pass.

Fig. 2 shows a practically standard horizontal-shaft turbine with the addition of a right-angle suction bend. This eliminates the use of bevel gearing, and for electrical work permits direct coupling to horizontal-shaft generators; in this case it is shown for a belt drive. Fig. 4 shows the efficiency curve of a Gilkes "Francis" turbine.

The Pelton wheel is the simplest and the most efficient form of water motor. Fig. 3 shows a small Pelton wheel arranged for belt drive. This is used in place of the re-action type when the head is relatively high and the quantity of water relatively low, and is therefore always used in conjunction with a pipe line. There is a number of different designs and arrangements to suit the varying conditions which occur in practice. Fig. 5 shows a Pelton wheel with a shaft governor and directly coupled generator supplied by Messrs. Gilbert Gilkes, operating on a head of 215 ft.

To meet the requirements of many hydraulic engineers, Messrs. Gilbert Gilkes have designed and placed on the market a turbine known as the "Turgo" impulse wheel. Fig. 6 shows a "Turgo" wheel set complete, which has a capacity intermediate between that of the Pelton wheel and the low-capacity re-action turbine. Many situations were found

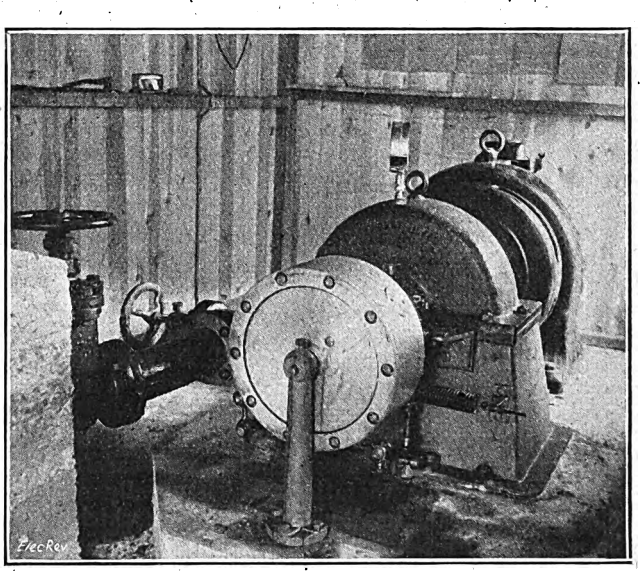

Fig. 5.—Pelton Wheel with Shaft Deflector Governor.

where the Pelton wheel would run too slowly, but where the re-action turbine, with its less perfect speed regulation and rather delicate wearing parts, was unsuitable.

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This wheel has all the simplicity of, and is exactly similar to, the Pelton wheel in so far as the jet is concerned, and

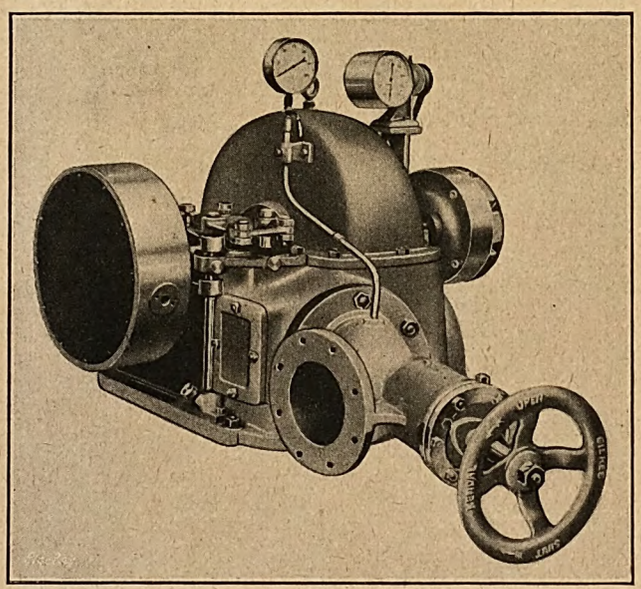

Fig. 6.—Complete "Turgo" Wheel Set.

like the Pelton it is a pure impulse or "free deviation" wheel. Many of these sets are being installed to-day with highly satisfactory results for rural and country-house lighting schemes and general industrial work. Fig. 7 shows the inlet (left) and outlet (right) sides of a "Turgo" impulse wheel.

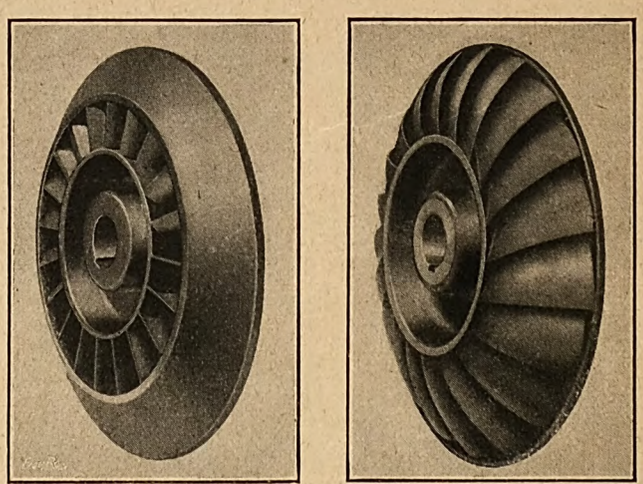

Fig. 7.—Inlet and Outlet "Turgo" Wheels.

Figs. 8, 9 and 10 depict sections of a low-pressure hydro-electric plant as carried out by the West Wales Electric Co. for an estate in North Wales. Fig. 8 is the tail race and power house; fig. 9 is the turbine in position in the wheel pit; and fig. 10 is the controlling dam across the river. The voltage in this case is controlled by an automatic Cox Walker "Reed Controller." The turbine was supplied by Messrs. Armfields, Ltd. An interesting installation consists of two sets of "Turgo" wheels directly coupled to alternators in operation at Cynwyd, North Wales, the larger being 21 in. in diameter and the smaller 12 in. The former is capable of developing 150 b.h.p., and the latter 27 b.h.p. The alternators have outputs of 112.5 kVA and 20 kVA, respectively. Special attention has been paid to the matter of governing. Each turbine has a shaft governor operating a deflector, combined with an overtaking gear which, on a sudden change of load, gradually varies the quantity of water passing through the nozzle. The working head of water in this case is 210 ft., and is led down to the power house in 18-in. riveted steel pipes. Superior speed regulation and the part-gate economy of this type of turbine will frequently weight the balance in its favour, compared with a re-action turbine.

The development of water power for small towns or estate power supply purposes requires very careful study owing to the large variations which usually occur in connection with the small rivers or streams which supply the power. If the best results are to be obtained, it is quite essential that the most suitable type of plant is installed, and it is rarely possible to use standard arrangements. These sets can either work directly on the electricity mains under the control of an oil-pressure governor, or through batteries, when a governor may not be essential in certain cases.

It is quite satisfactory to work directly on the mains, provided there is sufficient water to meet the demand. Batteries only become necessary when the demand exceeds the continuous power available. Turbines are usually arranged for horizontal running, but in some cases it is necessary to arrange for vertical running, owing to locality, building or pit arrangements, &c., and so far as the cost of the turbine itself goes it is the cheapest arrangement. The turbine is a simple type specially suited for heads up to 20 ft.; it is mounted on the suction tube, which can be either of steel or concrete. With small power installations, say, up to 15 b.h.p., the power may be transmitted from the pulley on the vertical shaft to the generator by means of a quarter-twist belt drive. With larger units the transmission is usually effected by bevel gearing, the design of which varies considerably with the work to be performed. With a reasonably high speed, a satisfactory arrangement is to couple the turbine shaft directly to the vertical generator. This combination reduces building costs to the minimum, and ensures very silent running and the minimum of upkeep. The total weight of the revolving parts, including that of the turbine runner, is taken by means of a thrust bearing, usually situated on the top of the generator frame. A typical vertical-shaft arrangement is shown in fig. 11; although a portion of the turbine pit of this installation is shown made of timber, the writer is very much more in favour of concrete for all this work.

Generators are usually directly coupled to the turbine shafts by means of solid half-couplings or flexible couplings, but if it is a case of keeping the cost within limits they are often belt driven, as in that case the speed of the generators can be kept high.

Pipe lines are sometimes laid out for low heads in reinforced concrete, which gives satisfactory results provided the lines are carefully designed and proper attention is given to allow for contraction and expansion. Iron pipes, however, are more generally used, the size of the pipe being so calculated that no undue proportion of the head is lost in friction, and also that no unreasonable outlay is incurred. The pipes themselves are laid on the surface of the ground, in the ground, or

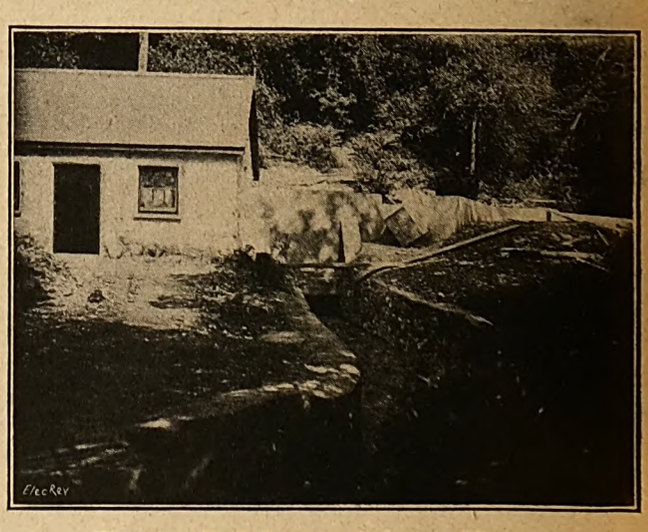

Fig. 8.—Tail Race and Power House.

on supports, much depending on the nature of the ground to be traversed. Proper provision in every case should be made for anchoring a pipe line, particularly

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at the bends. The joints in the case of small power schemes are usually of the socket and spigot type, or flanged in the case of riveted pipes. The most economical size of pipe line is that for which the annual value of the energy wasted, due to friction loss, is approximately equal to the annual interest on the investment. An average value for allowable loss of head due to friction

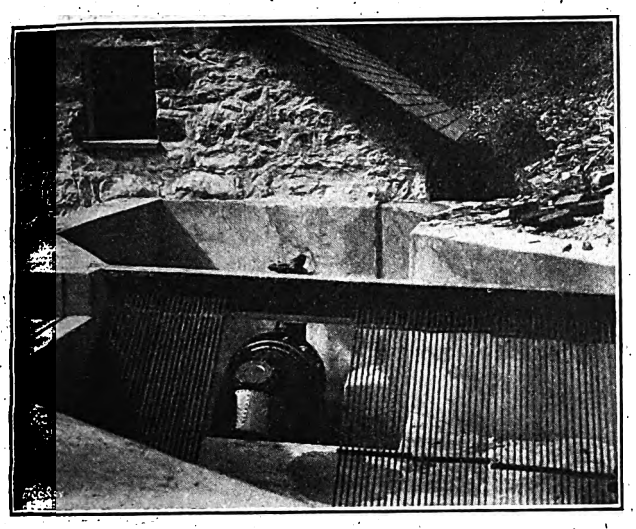

Fig. 9.—Turbine in Wheel Pit.

to comply with this law is from 3 per cent. to 7 per cent. In connection with head races for low-pressure turbines, their cross-section area is most important with very low falls, where only a few inches will make quite a considerable difference to the horse-power available. The velocity of water in such cases should not exceed 2 ft. per second.

It may be of interest to give a few typical examples that have been worked out of the annual costs of some

TABLE I.

	Per annum. £ s. d.
Anthracite for gas engine	200 0 0
Oil, waste, and sundries for gas engines	20 0 0
Battery repairs and depreciation	70 0 0
Repairs to gas engine and plant	50 0 0
Attendance on gas engine and electric plant and estate machinery (two men and boy)	325 0 0
Coal and coke for cooking, hot water, and central heating	140 0 0
Total	£785 0 0

small hydro-electric installations as installed by Messrs. Armfields, Ringwood, the figures of £7 12s. 9d. per

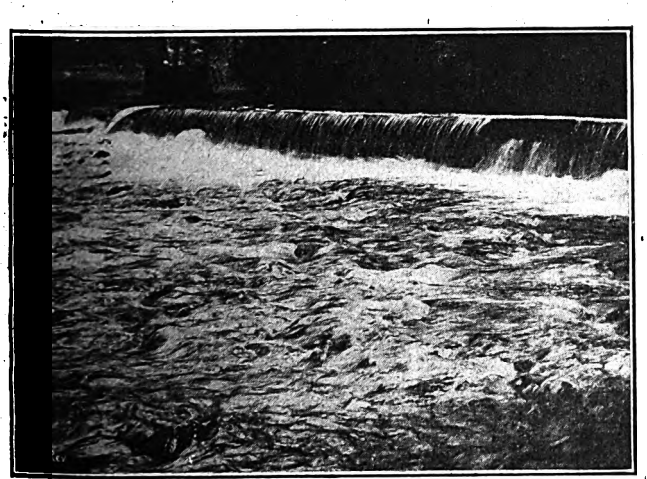

Fig. 10.—Controlling Dam Across River.

cent. per annum having been taken to cover interest and depreciation. This figure is one on which the Lands Improvement Co. is prepared to advance loans for such schemes, and provides for repayment in 20 years. As the life of hydro-electric plant is certainly much greater than 20 years, the figure is a very conservative one.

TABLE II.

Two 40-b.h.p. hydro-electric generating sets:—

Capital cost	£4,325
Less sale value of old plant	420
	£3,905

	Per annum. £ s. d.
Interest and depreciation	298 0 0
Attendance on estate machinery (1 man and boy)	175 0 0
Oil, waste, and sundries...	5 0 0
Total	£478 0 0
Less saving in domestic labour (1 maid and boy)	£105 0 0
Balance	£375 0 0
Advantage in favour of conversion	£412 0 0

Consumption: 200,000 units per annum; cost per unit, 0.575d.

TABLE III.

The oil-engine costs were:—	
Coal for range	£72 0 0
Petrol and paraffin for engine	42 0 0
Battery repairs	15 0 0
Engine	8 0 0
Oil, waste and sundries	5 0 0
Attendance (average 2¼ hours per day)	54 0 0
Total	£196 0 0

The hydro-electric costs were:—	
Cost, including layout of pipes, intake works foundations, overhead transmission line, electric cooker and water heater	£725 0 0
Less sale price of oil-engine set	70 0 0
...	£655 0 0
Interest and depreciation	£50 0 0
Oil, waste, and sundries	2 0 0
Repairs	3 0 0
Attendance	9 0 0
	£64 0 0
Less saving in domestic labour	£60 0 0
	£4 0 0
Advantage in favour of a hydro-electric plant ...	£192 0 0

Consumption: 45,000 units per annum; cost per unit, 0.375d.

Example 1: *Country House and Estate.*—In this case a river with a slight fall passes through the estate. The approximate requirements were as follows:—

Lighting, 350 points; pumping, 2,000 gal. per day; sawing (average), 25 b.h.p., 6 hours per day, 3 months per year; refrigerator, 2 b.h.p., 4 to 8 hours per day; sundry motors for farm work, &c. (average), 2 b.h.p., 8 hours per day; cooking; hot water for domestic supply; and central heating.

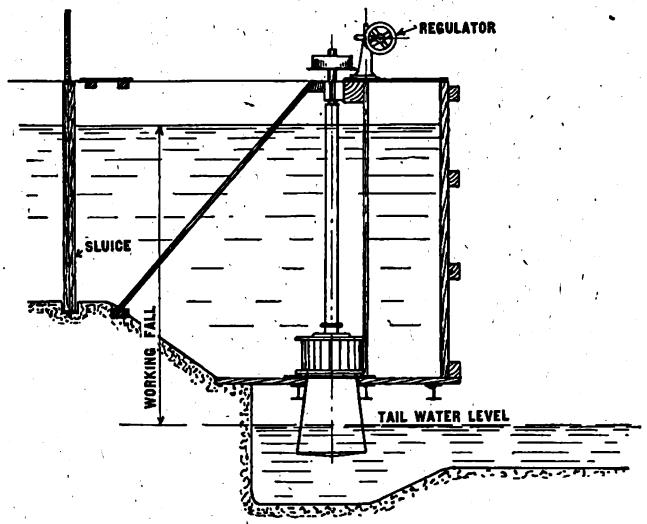

Fig. 11.—Vertical-shaft Turbine Arrangement.

There had been installed two suction gas plants, each of 30 b.h.p., and the cost of running them, together with the coal for domestic purposes, worked out as in Tables I and II.

A hydro-electric plant was installed on a fall of 3 ft. 6 in. Two turbines of 40 b.h.p. each were installed, each with governor and generator. In the following

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comparative figures, no general depreciation or interest has been allowed on the old plant, but its sale value has been credited as part payment for the hydro-electric plant.

Example 2: *Country House, Used as Boarding Establishment.*—An old-engine set had been installed, and the house wired for 120 lighting points; an ordinary coal range, with a back boiler for domestic water supply, was used.

A small stream was available, with a fall of 25 ft. in a distance of about 150 yards. A large pond was also available from which the water was conveyed in concrete pipes to the site of the hydro-electric generating plant. An enclosed-type turbine of 15 b.h.p. was installed, together with the necessary generator and governor, the electricity being taken a distance of 250 yards to the house by overhead cables.

The data for this example are given in Table III.

Rural Electrical Development.

Some difficulties and a few suggestions for overcoming them, remembering that there is room for co-operation between those who desire to preserve the rural aspect of the countryside and those who are attempting to provide it with cheap power.

By W. FENNELL, M.I.E.E.

(*Concluded from page* 647.)

We in England were regulated out of the air into the earth very early (1882) and there we stayed until, painfully and slowly as a result of agitation, it was agreed that the stringency of Overhead Line Regulations should be reduced. We then fell into the hands of a Committee which, about five years ago, calculated the strength of overhead work as a beautiful theoretical problem in statics. It made assumptions, based upon the climate of Canada, in relation to ice loading, &c., and applied them to lines of all classes in our humid climate. As a result it is nortorious that ours is the one country in which truly rural development is impossibly expensive, because we are being forced to put up unnecessarily strong and expensive overhead h.p. secondary lines. Is there any real difference between the climate of England and that of North-Western France, or the warmer parts of the U.S.A., which makes what is safe there dangerous here? The happy solution of the foreigner and our unhappy lack of solution of this problem are, the writer believes, due to the fact that the foreigner was allowed to adopt the method of trial and error, and the result is something which, over a long period, has shown itself to be strong enough for his conditions. The method of trial and error, which the highbrow calls rule of thumb, has beaten the method of stress calculations because it is not based upon inaccurate assumptions for sub-arctic conditions, but upon experience.

The writer suggests that, as national funds are to be spent on rural experiments, it would be good policy to erect some dummy lines of strengths graded from those stipulated in the present Regulations downwards and see what happens to them in England. Ten miles of such lines in an exposed place, say on a Lancashire moor subject to westerly gales, for a year or two, and costing, say, £2,000, would provide a real basis for British regulations.

There is a matter of procedure that requires serious discussion at the present time. The 1919 Electricity Act dispenses with the veto of the local authority and substitutes " a right of being heard " before the Ministry of Transport sanctions overhead work. The practice was, and is, to require the undertakers to apply for sanction for each individual line from the Electricity Commissioners and the M. of T., and to produce the approval of the local authorities. If the latter is refused, there is a local inquiry, which takes several months to arrange. This procedure was designed for a time when overhead work was exceptional and infrequent. Matters have now progressed so far that large areas are being developed gradually and entirely by overhead work, and the result of this method is disheartening to those engaged in it, because it keeps agitation alive and delays each extension. The writer suggests earnestly that every undertaker should be enabled to obtain consideration of a general sanction for overhead development of an area by depositing a plan, and that the local authority be heard as to the area instead of as to each separate line. The Commissioners could then recommend consent, subject to approval by them of construction methods, for those portions of the area where they are satisfied that overhead work must be used, and retain the method of individual application for doubtful portions. This suggested method would comply with the Act just as completely as the present method, and would ease the work of the Commissioner's staff and so save expense, while avoiding delay. The present methods will be absurd for, say, the Lincolnshire scheme, and the suggested method might be tried out at Bedford forthwith.

In putting forward the above proposal the writer may mention that he inserted a clause to effect this in the Mid-Cheshire Draft (1924) Order, but it was deleted by the Ministry of Transport. Since that date almost the whole of the suggested overhead area has been developed by overhead lines, but dozens of separate applications have had to be made to local authorities, and some have been delayed six months and even longer, to the great inconvenience of the public, but no application has been refused. The writer's company is now applying for an extension order for an area of 40 sq. miles to be developed entirely by overhead work, and many others are, or will be, in a similar position.

The writer feels he must issue a serious warning against what he observes to be the usual practice in dealing with outer suburban " ribbon building " work, *viz.*, that of erecting long 400-V, 4-wire, distributing mains of about 0.05 sq. inch area supplied through a sub-station. Such lines will be the very worst advertisement possible for electricity supply. As soon as even a few consumers use electricity for cooking and heating on such a line a serious voltage-regulation crisis will arrive. Rural work means high-pressure work (almost up to the consumer) and the compound line, *i.e.*, high- and low-pressure conductors on the one pole, is a solution of the problem of ribbon building. We cannot, how-

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ever, carry out high-pressure house-to-house distribution in rural England on an economic basis, unless the High-pressure Regulations are eased, so the authorities have to choose between following the example of the Government as to light railways, or of seeing a system established which will only deal with lighting in rural areas at a time when everyone knows that electric cooking, heating, and power are needed quite as much as lighting, and will be demanded.

With regard to the thorny subject of wayleaves, it is always much easier to deal with it when the "rural amenities" issue is not to the fore. The Electricity Commissioners are doing what they can within the limitations of the Act, the intent of which is to a great extent defeated by the ponderous procedure which was attached to it. No one dare apply Section 22/1919 unless he is willing to risk waiting from three to six months for a decision under it, and spending an amount equal to from 20 to 100 years' purchase of the wayleave rental demanded in obtaining a reduction of that rent. This would be humorous if it were not tragic.

The recent issue of an elaborate draft wayleave form unfortunately offers little hope of assistance, unless it can be cut down to a simple consent with a few short clauses indicating the obvious facts that the undertakers take all risk, pay for all damage, and are carrying out a public service, which must not be looked upon as an additional source of unearned rent to the landowner. We cannot be expected to pay for "moral and intellectual damage" by reason of the line, unless the owner is also prepared to hand over the unearned increment he may obtain by reason of the increased value of his property following from the provision (without cost to himself) of electric light and power on tap. As soon as the mains are erected one sees in advertisements for local land and property sales "electric light available on the estate." The least that can be done in return for this is the offer of nominal wayleave rentals.

The writer wishes to say in conclusion that there are local authorities which welcome overhead lines, landowners who recognise their responsibilities as such to their tenants, and to their neighbours who cannot afford private plant, and farmers who send in reasonable claims for damage done. It is a pleasure to deal with them and a duty to see that their confidence is rewarded by every form of consideration from us in carrying out our works. This article therefore ends on the cheerful note that we must be thankful for small mercies and work so that "the little leaven leaveneth the whole lump."

Electricity for the Home.

Evidence of Progress in Domestic Electrification at Kingston and Brighton.

KINGSTON-ON-THAMES (engineer and manager Mr. T. A. Kingham) is another undertaking which has approached the domestic-electrification problem with zeal. One of the most interesting points in connection with this undertaking is that no two-part tariff is in vogue. There is a flat rate of 5d. per unit for lighting and ¾d. per unit for other domestic purposes. Out of a total of 170 cookers now out on the mains, 68 were installed last year. "Magnet" cookers seem to be very popular at Kingston.

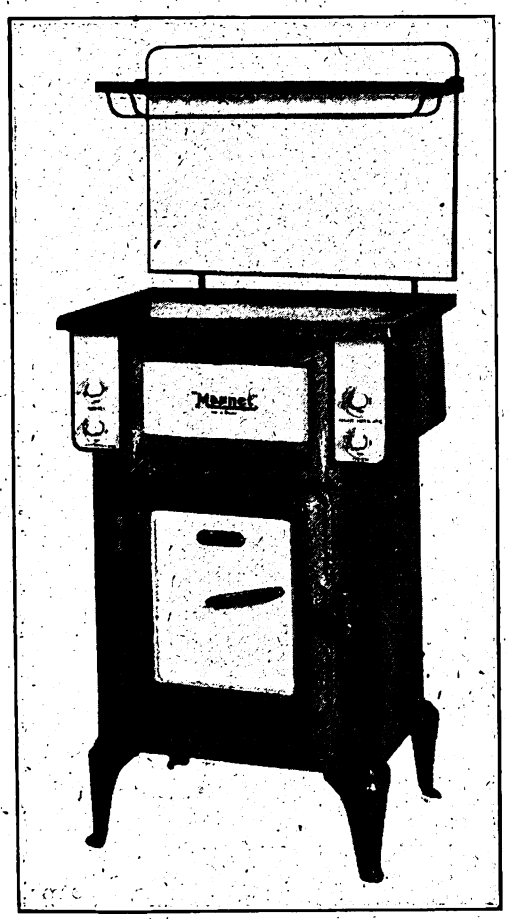

Fig. 1.—"Magnet" Cooker (D.C. 5746) which is Popular at Kingston.

There are at the present time considerably over 100 cookers made by the General Electric Co., Ltd., in use by consumers under the Kingston-on-Thames electricity undertaking. These cookers are of the d.c. 5,760 and d.c. 5,746 types, fitted with oven thermometers, plate racks and white enamelled splashguards. They are identical in the principal points of their construction, the ovens being fitted with side, or side and bottom heat, and enamelled interiors rounded at all the corners, which are entirely withdrawable for cleaning purposes. The important differences in design apply mainly to the dimensions and capacity of the ovens and hotplates. The larger of the two types, d.c. 5,746, fig. 1, is intended for a household up to six persons, and the d.c. 5,760 for four persons. A particular feature of the latter is that, though small, it is nevertheless complete in equipment and embodies an oven, grill, and totally

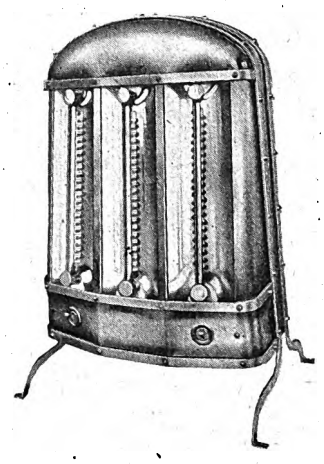

Fig. 2.—"Inventum" Fire, Sheet-metal type used at Kingston.

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enclosed hotplates, all arranged for three degrees of heat and separately controlled. The illustration shows the model in the de luxe finish, and it will be seen that the grill is fitted between the oven and the hob, but in the d.c. 5,746 model the grilling outfit is fitted within a large hot cupboard and can be completely withdrawn when the cupboard is required for warming plates, &c. The standard finish provides for a porcelain hob enamelled mottled grey, with the exterior, including facings and feet, in black stoved enamel; the removable

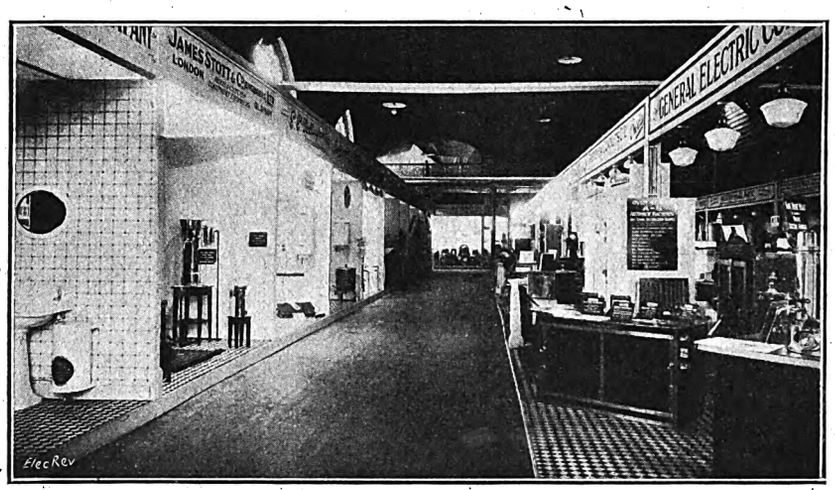

Fig. 3.—A View of the Water-heating Section at Brighton Exhibition.

oven interiors are of enamelled porcelain, and the oven door and switch panels enamelled white.

There is evidently a big demand for electric fires at Kingston. Out of a total of 373 radiators connected to the main at the end of the financial year, 207 were put out last year, mostly on hire. "Inventum" fires of the type shown in fig. 2 are largely used. This is the 3-bar sheet-metal fire.

The elements are of the plug-in type, and the actual heating coils are supported throughout their entire length. Ample room is provided for contraction or expansion. A number of finishes can be obtained, and the fire is supplied with either of two loadings, 1,500 W or 2,100 W. The weight is 11 lb. Bronze or brass reflectors are usually supplied, but the fires in heavy type can be provided with chromium-plated reflectors.

Kingston offers all types of "Inventum" water heaters, in addition to other makes; for the kitchen they recommend the 1½-gallon 454 heater, and for the bathroom the 455a heater of 10-gallon capacity and upwards. The inner tinned copper container and outer galvanised-iron casing, with shredded cork lagging in between, the sheathed immersion elements and automatic switch (thermostat), &c., are features of the apparatus by Inventum, Ltd. An important provision is that the whole of the internal components, including inlet and outlet pipes, are mounted on a detachable base. They can be removed bodily simply by undoing the flange fixing bolts. This greatly facilitates internal inspection and cleaning. A single cock, or tap, only is required to be fitted on the cold water inlet pipe. When this tap is opened cold water flows in and automatically displaces a corresponding quantity of hot water through the outlet pipe. Turning off the cold water supply causes the flow of hot water to cease. The cistern thus operates on the push-through principle.

Since water expands on heating, a small amount would be forced over the top of the outlet pipe and result in a continuous dripping as the freshly-introduced cold water is heated up, unless means to prevent this were provided. This source of irritation is entirely overcome by the "Inventum" patented non-drip device.

At the end of March last there were 190 kettles, 247 irons, and 33 water heaters hired out by the undertaking. The hire charges for cookers vary from 7s. 6d. to 12s. per quarter, including a thermometer and a 3-pint kettle. Radiators are hired out at from 2s. 6d. to 5s. per quarter, and water heaters at from 3s. 6d. to 9s. per quarter. Cookers are wired free up to 60 ft. The undertaking does its own repairs, and, as has been experienced by most undertakings, the maintenance costs have proved very low as the result of using closed-type boiling plates. A psychological point which is experienced by the department is that non-cooking consumers are "afraid" of electricity; they won't believe the heat is there because they cannot see it. There are very few dissatisfied consumers nowadays, and the old complaints about the time required for boiling plates to get hot seem to have been straightened out by the inclusion of an electric kettle as part of each cooker.

Gas at Kingston is 10d. per therm, and after conversion from gas to electricity for cooking or heating, consumers do not find their bills increased. There are a few all-electric houses, except one coal fire, on the Kingston system, and the meter readings given are a typical example of the consumption for an "all-electric" consumer with a normal family. The readings are: June quarter, 802 units; September, 785 units; December, 680; and March, 1,055 units.

Naturally consumers prefer new cookers, and the installation of renovated or used apparatus presents a problem. The undertaking seems to have overcome this in an excellent manner: new cookers are hired out on a three-years' agreement only, and old ones are sent out on agreement for one year.

The Brighton Exhibition.

That Brighton Corporation Electricity Department appreciates the importance of the domestic load was demonstrated by the opening by the Mayor (Alderman H. J. Galliers, J.P.) on October 10th, at the Dome and Corn Exchange, of an electrical exhibition. The latest effort was by far the largest and most impressive, and, with the assistance of the Electrical Development Asso-

Fig. 4.—The Heating and Cooking Section: A Representative Display.

ciation, resulted in a marked advance on previous displays.

The exhibition was divided into four main sections, *viz.*, water heating, heavy appliances, lighting and miscellaneous, and a large hotel demonstration kitchen and restaurant catering for the full requirements of the stall holders and the public, serving luncheons, teas and dinners.

One of the chief features of the show was the water-heating section, which set up a new standard for exhi-

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bitions of this description. This section was of an exceptionally representative character, combining apparatus by the whole of the manufacturers of electric water heaters. Similarly, the heavy-appliances section consisted of an unusually large display of cooking appliances by all the recognised manufacturers. Heating was also represented by all the principal manufacturers, and in addition to the radiant heat and imitation coal fires, included a display of low-temperature tubular heaters which are now becoming very popular for use in large buildings. The feature of the lighting section was the almost general display of anti-glare fittings which are now recognised as the most efficient means of illumination. This system of illumination was emphasised by the Electric Lamp Manufacturers' Association whose stand included models of interiors of rooms and workshops in which the old and new ways of lighting were effectively contrasted.

The Electrical Development Association adopted an attractive method of educating visitors in the uses and advantages of electrical appliances in the home, which proved very popular. It gave a series of spectacular electrical tableau demonstrations consisting of simple wordless plays, which introduced domestic appliances in the ordinary routine of the housewife.

The Corporation Electricity Department was content to leave the display of appliances to the rest of the exhibitors, and its stand served as an inquiry bureau where visitors were furnished with particulars of charges and were given expert advice with regard to proposed installations.

A new 15,625-kW turbo-alternator was inaugurated by the Mayoress at the Southwick power station on October 12th, bringing the capacity of the undertaking up to 40,425 kW. The maximum load on the generating plant last year reached 18,700 kW, so that with a population of over 140,000, of which at March 31st last 19,694 were consumers, it will be seen that the undertaking has both scope for domestic development, and sufficient plant to meet requirements for some time to come.

In addition to the E.D.A., E.L.M.A., and the Corporation Electricity Department, the exhibitors included the following:—Siemens Electric Lamps & Supplies, Ltd.; James Scott (Engineers) & Co., Ltd.; Electric Fires (Norwich), Ltd.; Carron Company; General Electric Co., Ltd.; H. J. Galliers; Jackson Electric Stove Co., Ltd.; Belling & Co.; Drake & Gorham Wholesale, Ltd.; Page & Miles, Ltd.; Koldah Cooling Machines, Ltd.; Berry's Electric (1928), Ltd.; Electrolux, Ltd.; Ferranti, Ltd.; Moffats, Ltd.; Metro-Vick Supplies; Hotpoint Electric Appliance Co., Ltd.; E. E. Fellingham; Sadia, Ltd.; Credenda Conduits Co., Ltd.; Revo Electric Co., Ltd.; Young, Osmond and Young, Ltd.; Edison Swan Electric Co., Ltd.; Santon, Ltd.; and A. Reyrolle & Co., Ltd.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

A Compact Testing Set.

Messrs. Ferranti, Ltd., Hollinwood, Lancashire, have recently announced the introduction of an unusually compact multi-range d.c. testing set, fig. 1. Although of a convenient size for carrying in the coat pocket, this instrument is adequate for any type of d.c. test, having self-contained ranges from 0-1 milliampere to 0-25 amperes, and from 0-10 millivolts to 0-250 volts. B.S.S. first-grade accuracy is obtained, it is

Fig. 1.—"Ferranti" Multi-Range Test Set.

claimed, on all ranges, and, when required, an additional range of 0-500 volts can be obtained by the use of a small external resistance box, or a self-contained instrument reading up to 600 volts can be supplied. In addition, a terminal is provided for the use of any standard external shunt, thus extending the ampere range indefinitely. Replaceable cartridge fuses protect each movement, the movements being independent of each other, thus allowing of simultaneous readings of voltage and current. For workshop or outside service tests where a compact, robust instrument is required, this testing set is useful, having been designed to be as nearly universal as is possible in so small a compass, whilst maintaining a high standard of robustness. Mirror scales ensure great accuracy of reading, making the instrument eminently suitable for precision readings in laboratories and test-rooms.

A Small Motor-Starting Switch.

The accompanying illustration, fig. 2, is of the d.p. "Twinob" single-phase, motor-starting switch recently introduced by Messrs. A. P. Lundberg & Sons, 477 to 489, Liverpool Road, Holloway, N.7. It has been specially designed for starting single-phase motors by what is known as the split-phase method, with the starting and running windings in parallel to start the motor, the former being only in circuit temporarily. The new double-pole construction embodied pro-

Fig. 2.—The D.P. "Twinob."

vides for the isolation of the motor circuit from the supply. A cover of brown bakelite is fitted, and this is designed for a recessed knob. The hooded lever is under the control of a spring, *i.e.*, it returns to its normal or off position when pressure on the hood is removed. This spring-controlled lever encloses the other, and carries it along with it when pressed. On release of the pressure, that is, when the motor has started properly, the hooded lever returns to its normal "off" position, thus cutting the "starting" winding of the stator out of circuit. The other lever, remaining in its "on" position, controls the running winding, the motor being stopped when it is thrown into its off position. The current to the motor is broken on *both* poles.

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A Metal-Coating Process.

By means of apparatus introduced by Metals Coating Co., Ltd., 22, Birchin Lane, E.C., it is claimed to be possible to apply an exceptionally durable coating of any commercial metal upon any other metallic or non-metallic surface. Metallic coatings may also be applied to non-metallic materials such as wood, stone, brick, glass, porcelain, concrete, leather, and fabrics. The thickness of the coating may be varied, according to requirements, from 0.001 inch up. The metal to be deposited is used in the form of ordinary commercial wire, and any metal that can be drawn into wire can be used. The wire enters the tool at the rear, is fed automatically from a reel through the nozzle and into contact with an oxy-acetylene flame which melts the wire and, in combination with compressed air, blows the atomised metal against the surface, being coated at a velocity of about 3,000 ft. per second. The metal, as it impinges against the surface at this high velocity, solidifies and practically becomes an integral part of the surface. The tool weighs only 3½ lb., and is manipulated by hand for most work.

An Improved Radiator Heater.

No. 3 model "Peter the Heater" is a combined inspection lamp and automobile radiator heater recently introduced by Messrs. L. G. Hawkins & Co., Ltd., 30/35, Drury Lane, W.C.2. The article is constructed in the form of a lantern, with the heater in the hood, and equipped with an efficient portable inspection lamp, reflector and a hinged wire-guard protector. Hook suspension is provided for hanging the apparatus under the bonnet. Switch control—"lamp," "off," and "heat"—is arranged in the base of the lamp. The device is supplied complete with a length of three-core workshop flexible cord.

"Rockbestos" Products.

As we recently announced, British Insulated Cables, Ltd., has taken up the sale and manufacture of "Rockbestos" products in this country. "Rockbestos," the asbestos-covered wire, is made by processes involving the use of special machinery and should not be confused with ordinary wires taped or braided with asbestos. In the "Rockbestos" process the insulation is composed of pure, long-fibred asbestos, thoroughly separated, carded and spun into a yarn or roving which is wound uniformly upon the conductor, saturated, except in the case of heater cords, with a chemically neutral compound and submitted to a polishing process which finishes and consolidates the insulation. The colour of the insulation may be white or black, depending upon requirements. Black compound is used in all cases where moisture may be present, and white compound where heat is intense and moisture is absent. "Rockbestos" insulated wires and cables have a very wide field of application in heating apparatus of all kinds, windings for industrial motors, cables for power stations, switchboards, motor controllers for power and traction, electric furnaces, kinematograph and other arc lamps, &c., where their heat-resisting and flameproof qualities are an insurance against breakdown through accidental overloads and against fire. "Rockbestos" covered wire will run red hot and still remain capable of service.

"Personal" Salesmanship.

The First E.D.A. Conference of the 1929-30 Session.

THE 1929-30 series of Salesmanship Conferences organised by the British Electrical Development Association in London was opened at the Royal Society of Arts on October 18th, when Sir Andrew Duncan (Chairman of the Central Electricity Board) was in the chair. The lecturer was Miss Gladys Burlton, who chose as her subject "Personal Salesmanship in the Electrical Industry."

Miss Burlton is undoubtedly a clever exponent of the art of salesmanship, and she endeavoured to forestall criticism to some extent by admitting at the very commencement of her lecture that she knew nothing about the electrical industry. It quickly became apparent that this was the case, and the lecture was ostensibly from one who viewed the matter of personal salesmanship in the electrical industry as a customer. Even so, it quickly became equally apparent that Miss Burlton either had not been in any showrooms of important supply authorities or had made such a hurried endeavour during some days preceding her lecture to prepare herself with material that she utterly failed to present a true picture of the actual position. Even with this somewhat severe criticism, which we feel justified in making, there was also an apparent desire on the part of Miss Burlton to score points at the expense of the electrical industry and particularly those engaged on the sales side, by applying some of those deft touches which are so familiar to the practised public speaker who has no solid foundation for some of his or her statements. The lecturer seemed to imply that everything that could possibly be wrong with the sales side of the electricity supply industry was wrong. Nobody concerned with the sales side of the supply industry will suggest that there is not considerable room for improvement in all directions, but even the most modest of those whose daily task it is to endeavour to sell electrical apparatus and fittings could not sit down under the castigations of Miss Burlton and feel that they were just. Indeed, it may be that the lecturer was indulging in leg-pulling of a very vigorous kind. She hinted that she had been making a round of showrooms belonging to supply companies and municipalities, and when one speaker frankly doubted it and suggested she had been to Selfridge's or Harrod's, Miss Burlton blandly smiled, and in her reply did not deny the suggestion. On one occasion Miss Burlton, when making a charge of hopelessly inefficient methods against some showroom assistant, accidentally or otherwise, said she had gone in to buy "a gas fire" but quickly changed the phrase to "an electric fire" when the audience roared. We cannot believe that such methods are used even in a gas undertaking's showroom. In the same way she spoke to an incredulous audience when she suggested that it was in an electricity supply showroom that the assistant did not know the voltage of the district!

We have made this variation of our usual reports of the E.D.A. Conferences because of the peculiar nature of the lecture in many respects, and our doubt whether lectures should be given by people utterly unfamiliar with the electrical industry, unless they confine themselves to generalities and do not enter upon specific criticisms which, even if they be true of some small showroom, must be promptly and strongly refuted as applying to the supply industry as a whole. A strong light was thrown upon Miss Burlton's knowledge of the industry when, replying to someone who had mentioned the I.M.E.A., she said "the I.M.E.A., whatever that may mean."

There were, however, good points in the lecture which were of value to those who listened to it. So long as the speaker kept off the type of superficial comment to which reference has been made—which one speaker in the discussion said no man in the industry would dare to make and not be put against a wall and shot—the lecture was thoroughly interesting, although it must be confessed that the suggestions as to the need for personality, knowledge of the article being sold, confidence in the article being sold, and so on, have been made at many a previous conference and form the subject of the lessons provided by salesmanship schools. Nevertheless, nobody would deny that Miss Burlton has personality, and whilst she lectured on personal salesmanship as such she was intensely interesting.

As some examples of the criticisms made, we were told that those engaged in showrooms in the electricity supply industry bore the entrance of possible customers with fortitude, and that in some cases Miss Burlton's presence was not even acknowledged the whole time she was there. Whether she meant by this that she had gone out without being attended to she did not make clear. Reference was made to a showroom—presumably electrical, but not stated to be so—where Miss Burlton was met by a commissionaire who, when she said she wished to look at some fires, said: "Oh!" and left her for a long time. Again, there were general charges that assistants in electrical showrooms were inclined to adopt a sort of "Post Office" manner, and that the customer, or would-be customer, was not made at home, and was given a bad impression. The whole lecture bristled with this kind of comment, which few in the room did not think was greatly exaggerated. At times even Miss Burlton must have felt she was going a little too far, for she added now and again, that of course she was exaggerating, "but you know the sort of thing I mean," which really was not very helpful

The discussion showed that the audience did not fail to catch the significance of the really good salesmanship points that were made in the lecture, and in general they were agreed with. There was, however, a very definite resentment of the general charges made, as already indicated, but as both the charges and the resentment were all in good humour, the meeting was in happy vein throughout. Speaker after speaker disclaimed the possibility of Miss Burlton having been in their particular showrooms and receiving the treatment that had been outlined, and it was left to one of her own sex, Miss C. Haslett, of the Electrical Association for Women, to reply to Miss Burlton most severely. Miss Haslett thought that if Miss Burlton could spare the time to spend six months or more in an electrical showroom, she would be in a position to give the E.D.A. a much more useful lecture than she had done. There was, she said, a totally different atmosphere in an electrical show-

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room from that in any other showroom, and that had to be understood to be appreciated. At the same time, Miss Haslett spoke of the fact that there was at the present time a great demand for trained saleswomen in the electrical industry, and that that demand could not be met because we had come to the end of the supply. She urged, therefore, the need for some definite scheme of training young girls for electrical showroom work, and expressed the belief that the industry had not yet realised that necessity, and was not treating the matter seriously.

Several speakers in the discussion agreed, as they were bound to, with the general points made in the lecture, and one even went so far as to accept as a fact that an assistant in a supply authority's showroom did not know the voltage of the district, and he instanced the possibility of that in his own showroom because the district had four different voltages.

Councillor Watt, of Woolwich, smilingly suggested that Miss Burlton was something of an actress, and complained of the foreign trash that was being sold in the large stores, and was doing harm to the industry.

Mr. Howell (Battersea), commenting on the many attributes of the successful salesman or saleswoman, as laid down by Miss Burlton, expressed the hope that the lecture would be repeated before the Electricity Commissioners and the I.M.E.A., because at the present time it seemed that salesmen and saleswomen having the many qualities outlined were expected for a salary similar to that now paid to a municipal dustman.

Mr Jackson complained that there were instances in the industry of enthusiastic young salespeople having their enthusiasm damped by the management, which was not as progressive at it should be.

Mr. Hayes also emphasised the need for training juniors, and complained of under-staffing in showrooms as well as inadequate payment. He urged salespeople to demand higher salaries, having regard to the technical knowledge that was required.

Many others took part in the discussion, and dealt with various points mentioned in the lecture, their remarks indicating a very live state of affairs in the sales departments and showrooms of the electricity supply industry.

Sir Andrew Duncan said he had visited a very large number of showrooms, and some of the more recently erected were very expensive and well laid out. The one question he always asked was: Where is the "complaints room"? He invariably got the reply, "We do not have complaints," but when he got that answer he always knew what to think. In another country he recently saw a most interesting illustration of how a sales department should be managed. The best room on the ground floor was set aside for receiving inquiries, and if anybody wanted to complain about anything he was attended to by the best salesman. On an upper floor there were from 24 to 48 telephonists attending to telephone calls from consumers; that was what he called real sales organisation. That, of course, was a very large undertaking, and there was room for it, and the same thing could not be applied to smaller undertakings. At the same time, it would be useful if the E.D.A. spent an evening having a general discussion on the general organisation of a sales department.

Miss Burlton, in the course of her reply, acknowledged that she would have been able to give a more useful lecture had she known more about the problems of the electrical showroom. She expressed the hope that if there were any representatives of management present they would take note of what had been said with regard to staffs and salaries; the golden rule for staff management was to select carefully, train carefully, pay well, and promote adequately. If those points were concentrated upon there must be a tremendous move forward in the industry.

A hearty vote of thanks was accorded Miss Burlton at the close of the discussion.

Many of those present remained after the meeting to hear a broadcast talk by Sir Oliver Lodge on "The Beginnings of Electric Light," which dealt with Sir Joseph Swan's invention of the incandescent electric lamp. The receiving apparatus was provided by the General Electric Co., Ltd.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

Our Telephone Number.

We wish to remind all of our friends that our telephone number is and has been for some time past:—

Central 5871 (5 lines).

The Patents Committee.

The Committee, which was set up under the chairmanship of the Right Hon. Sir Charles Sargant to consider whether any amendments in the Patents and Designs Acts, or any changes in Patent Office practice, were desirable, is continuing its meetings at the Board of Trade for the purpose of hearing evidence from interested persons and associations. Four meetings of the Committee took place before the vacation, and during the next few weeks evidence will be taken from representatives of the Trade Marks, Patents and Designs Federation, Ltd., the British Science Guild, the London Chamber of Commerce, the International Association for the Protection of Industrial Property (British Group), the Association of British Chemical Manufacturers, and the Chartered Institute of Patent Agents. Any persons or associations who desire to submit any further suggestions, or to give evidence, are invited to communicate with the Secretary, Mr. R. W. Luce, Industrial Property Department, Board of Trade, 25, Southampton Buildings, W.C.2.

Wages in the American Electrical Industry.

Included in statistics of United States wages and hours in the October *Ministry of Labour Gazette* are figures relating to the electrical manufacturing industry. The average hourly earnings are given as follows:—Unskilled males, $0.491; skilled and semi-skilled males, $0.687; and females, $0.429. The average weekly earnings for these three classes are:—$22.67, $32.39 and $16.49. The average number of hours worked per week (all classes) was 45.9. The wages paid were above the average for all industries and the hours worked below the average (48.2).

German Cable Exports.

Most of the German cable manufacturing firms are united in the two Berlin syndicates—the Schwachstrom Kabelverband for l.p. cables, and the Vereinigung Deutscher Starkstrom Kabelfabriken for h.p. cables. The syndicates exercise a regulating influence on prices, which they prescribe to firms making offers. During the past few years the syndicates have considerably strengthened their position, and to-day have a dominating control over the market conditions. Now some ten member firms have formed a company with a share capital of 500,000 marks to watch over the common interests of the participants, especially abroad. Among other matters, it is stated that the new company proposes to attend to propaganda and organisation. The exports of cables of all kinds from Germany rose from 42,000 tons in 1927 to 49,000 tons last year, the values having been 40 million marks and 47 millions, respectively. During the first half of 1929 the exports are stated to have amounted to 33,500 tons, valued at 35 million marks.

Franco-Dutch Lamp Agreement.

The Amsterdam correspondent of the *Financial Times* says that it is reported that Philips Glowlampworks has entered into a co-operative agreement with the French Thomson-Houston Co., which has resisted recent attempts by the American General Electric Co. to acquire a large interest.

The American G.E. in Russia.

According to a Riga message last week, the President of the Soviet Electrical Trust states that the agreement with the American General Electric Co. has been settled. The American company is to send a body of engineers to work in the Trust's factories, and has granted rights in respect of a number of patents, in particular those concerned with railway electrification. At the same time, it is reported that a director of the German A.E.G. is in Russia negotiating for a somewhat similar agreement.

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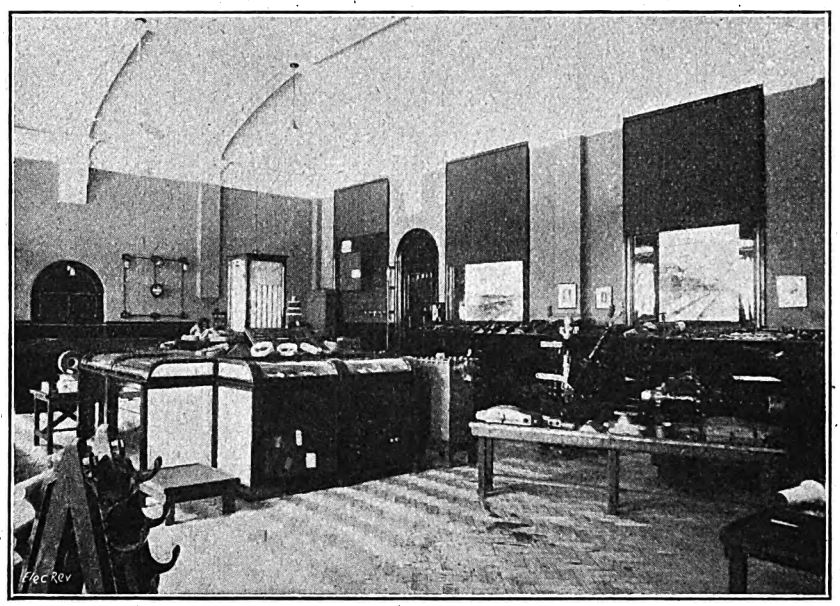
New B.I. Showroom.

A recent innovation at the Prescot works of British Insulated Cables, Ltd., is a large showroom containing examples of the very wide range of articles manufactured by the company. Joint boxes, cut-outs, paper pinions, house-wiring fittings, cables and flexibles, static condensers, electric welders, tramway and railway overhead fittings, and many other B.I. products are well displayed, while the room is hung with photographs of installation work. A lantern and kinema projector enable slides or films to be shown. The windows on one side of the room have been treated in a somewhat novel manner by filling them in with large, hand-coloured photographic enlargements of the Central Scotland overhead work and the Great Indian Peninsula Railway electrification contract. The showroom, which is illustrated herewith, has already proved very useful in affording visitors to the works a rapid and comprehensive survey of B.I. manufactures.



The B.I. Showroom, Prescot.

The Sydney Bribery Charges.

Reuter (Melbourne) reports that the full High Court has confirmed the conviction of Messrs. Babcock & Wilcox, Ltd., for bribery in connection with a contract for power plant for the Sydney Municipal Council, on an appeal by the Crown from a decision of the Appeal Court quashing the conviction. It will be recalled that S. Y. Maling, the municipal official concerned, was sentenced to six months' hard labour and fined £500. The company was later fined £1,000, and ordered to refund £10,600 to the Sydney City Council; it is this decision which has now been confirmed.

Recent Contracts.

Mention was made in our last issue (p. 681) of the placing of contracts for the equipment of the new underground railway in Buenos Aires with the Metropolitan-Cammel Carriage, Wagon & Finance Co., Ltd. It was there stated that the electrical part of the contract had been sub-let to the General Electric Co., Ltd. This covers the whole of the electrical equipment of the rolling stock, *viz.*, motors and control gear, for a total of 56 motor coaches. The latest type of G.E.C. (Oerlikon system) traction equipment will be fitted; the motors will be of the self-ventilated interpole type, arranged for field tapping, and the control will be of the unit-switch electro-pneumatic type. The equipment will have to deal with the heavy passenger traffic usual on urban and interurban railways, and the company's design is well calculated to withstand the most severe working conditions. The G.E.C. is also supplying the equipment for the lighting and the automatic door control of the coaches.

The English Electric Co., Ltd., has received an important contract from the South Indian Railway Company for the rolling stock required for the electrification of the Madras suburban services. The order comprises 17 three-coach articulated units, each unit consisting of three all-steel coaches, together with the necesary electrical equipment. In addition, there are four electric goods locomotives. The total value of the contract is about £170,000.

Messrs. Butters Bros & Co., McLellan Street, Glasgow, have secured the contract for the electric crane which will be used at Liverpool Cathedral. The crane will be one of the largest ever used in building construction; with jib elevated, it will be able to lift loads up to five tons to a height of almost 300 feet.

It is reported that Messrs. C. A. Parsons & Co., Ltd., have received an order from the Northern Provinces Electricity Co., Holland, for two 30,000-kW turbo-generators and condensing plant. The plant has to be ready for service by February, 1931.

New French Company.

A new French company has lately been formed in Paris (173, Route de la Revolte, Levallois-Perret), with a capital of 1,300,000 fr., and the title La Société d'Eclairage et de Technique Théatrale to specialise in theatre, kinema, and shop-window lighting installations.

Sturdy Electric Lamps.

Though incandescent electric lamps have glass bulbs, some of them seem to have iron constitutions. Among recent instances which have been brought to our notice of lamps which have withstood very rough treatment, the following are of interest. The first was an "Osram" lamp fitted in a street-lighting standard. An accident occurred which involved the standard and broke it off near the base. The top portion crashed to the pavement, but the lamp remained unperturbed and still shone brightly.

The other instance is provided by Metro-Vick Supplies. A friend of the company was walking along a deserted part of the sea-shore when he saw a lamp lying half buried in the sand. It proved to be a "Cosmos" lamp which, from its marking, had evidently been supplied to the Admiralty. It is presumed that it was thrown overboard from a warship, and had no doubt travelled some distance without damage apart from a slight loosening of the cap. It still functions quite well.

The E.D.A. November Programme.

The November programme of the British Electrical Development Association is devoted mainly to preparations for the Christmas season, as will be noted from the month's window display which we illustrate. This display introduces an up-to-date Santa Claus, who advocates the giving of electrical presents. Examples of appliances which are eminently suitable for this purpose are arranged in a simple group. The square columns upon which the appliances are mounted are from previous window displays, and the cost of the extra material is very small. The electrical Christmas gift idea will be the *motif* of large displayed advertisements in the principal London and provincial newspapers during the month, and other advertising schemes provide for the insertion of advertisements in many of the leading home journals, architects' newspapers, and the general Press. As usual, electros are available for the use of retailers in their local Press advertisements. The programme lists a number of E.D.A. publications appropriate to the season.

The E.D.A. November Window Display.

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and illustrates two of the showcards, which can be obtained from Savoy Street. The Electric Homes (Outlet) Campaign is surveyed, its objects and means of attaining them being set out in clear terms.

Irish Free State Electrical Imports.

The Irish Free State Ministry of Industry and Commerce has issued detailed figures of imports during the six months ended with June last comparing them with the corresponding half of 1928. From these we have compiled the appended table, showing the value of the total imports of electrical machinery and cognate material into the Free State, and the amount attributed to the United Kingdom as country of shipment, but not necessarily of manufacture :—

	Total imports. January to June,		U.K. share January to June,	
	1928	1929	1928	1929
	£	£	£	£
Electric wires & cables	91,131	102,781	25,183	49,046
Telegraph and telephone apparatus	5,779	14,621	4,845	13,501
Electric lamps & parts	21,244	36,595	15,916	21,600
Batteries & accumulators	11,539	12,854	10,533	10,558
Radio sets and parts ...	40,407	40,052	39,832	39,421
Other electrical goods and apparatus ...	43,573	104,814	29,514	82,257
Generators	4,978	60,183	4,703	8,168
Motors	11,985	19,635	5,786	15,975
Other electrical machinery	53,010	113,064	31,992	37,632
Totals	£283,646	£504,599	£168,304	£278,158

As will be seen, of the total imports £278,158, or approximately 55 per cent., came from ports of the United Kingdom, as against about 60 per cent. in the first half of 1928. The foreign imports, consisting largely of wires and cables, and electrical machinery, of which the bulk is credited to Germany.

An Inter-Imperial Electrical Contract.

Reuter's Sydney correspondent reports that an order has been received by the Clyde Engineering Co., Ltd., of Sydney, New South Wales, from South Africa for batteries costing over £100,000. The order is from a big commercial firm and was secured in the face of keen competition from English, German, and American battery manufacturers.

Employment during September.

The October *Ministry of Labour Gazette* states that employment in the engineering industry during September was still slack on the whole and showed a further slight decline in nearly all sections. In the electrical branch, however, conditions were still fairly good. The number of unemployed in the industry as a whole rose by 3,185 to 93,750, the proportion thus increasing from 9.3 to 9.6 per cent. The proportion of unemployed in the electrical engineering industry rose from 4.2 to 4.4 per cent., the actual number being 3,482. In the electrical wiring and contracting industry there was a slight improvement; the number of unemployed was reduced to 1,007, the proportion falling from 6.6 to 6.5 per cent. The electric cable, wire and lamp manufacturing group improved to a greater extent; the number of unemployed fell to 3,764 and the percentage from 4.9 to 4.4.

Finnish Electrical Imports.

According to a recent return, the value of the electrical machinery and apparatus imported into Finland during last year amounted to £1,250,050, as compared with £702,050 in 1927. No less than 43.5 per cent. of the imports are credited to Germany, 39.1 per cent. to Sweden, 6.4 per cent. to Holland, 2.2 per cent. to the United States, and 1.2 per cent. to Great Britain.

New Municipal Showrooms.

The new electricity offices and showrooms in Harmer Street, Gravesend, arranged by the Corporation Electricity Department, were opened on October 23rd by the Mayor, Councillor R. McGregor, J.P. Electric cooking demonstrations were given daily extending from October 24th to November 6th. Members of the electricity staff were present to give full information regarding domestic electricity supply and services, and there were on view a collection of the latest cookers, water heaters, fires, &c.

The G.E.C. and the Ideal Home Exhibition.

We have now received complete particulars of the competition which the organisers of the Ideal Home Exhibition and the General Electric Co., Ltd., have arranged. As we reported in a recent issue, a "Pavilion of Light" is to be erected at Olympia comprising a lounge, dining room, bedroom, nursery, kitchen, bathroom, garden lounge, two salons, and a service room. Prizes are offered to architects and collaborating artists for the arrangement of the first four rooms, while electrical contractors are invited to submit schemes for the equipment of the kitchen and bathroom. In addition, 20 prizes are offered to artists and art students for designs of electric lighting fittings for the home. Full details of the scheme can be obtained from the *Daily Mail* (Electrical Competition), Carmelite House, London, E.C.4.

Czecho-Slovak Import Restrictions Removed.

It is announced that the restrictions upon the importation of electric telegraph, bell and signalling apparatus and electric lamps into Czecho-Slovakia were removed on September 30th.

Bankruptcy Proceedings.

V. F. Maddox, 6, Homend Street, Ledbury, Hereford, electrical and wireless engineer.—The public examination of this debtor was held recently at the Shirehall, Hereford. The statement of affairs showed liabilities of £459, and assets estimated to produce £168, leaving a deficiency of £293. Debtor attributed his failure to giving too long credits, so that he could not pay wholesale merchants, and to his having had to pay costs of legal proceedings. Debtor stated that in 1921 he commenced to build up an electrical business. He had no capital and no premises, but used part of his father's shop. At first the business did not make enough to keep himself and his wife, but later he made a small profit. He had had loans from relatives amounting to £147. The examination was adjourned for completion.

W. J. Phillis, 87, Overton Road, Leicester, electrical engineer.—The receiving order herein was made on October 2nd on the debtor's own petition. According to the statement of affairs filed there are liabilities amounting to £311, as against assets of £31, leaving a deficiency of £280. Debtor attributed his failure to keen competition and lack of capital. From July, 1919, until the end of 1923, the debtor was employed as an electrician in America. He returned to England with about £220 savings, and for the next eighteen months was associated with two relatives in a small business. He later commenced business on his own account with a capital of £15. According to the debtor the electrical and wireless side of the business and the wiring of houses by contract was fairly successful until 1928, when competition became keener. Since March last his work has been limited to wiring houses for a builder. The debtor states that he became aware of his position in January last. The first meeting of creditors was held on October 18th, at the Official Receiver's office, Leicester. The case, being a summary one, was left in the hands of the Official Receiver. The following are creditors :—

	£		£
Edison Swan Electric Co., Ltd.	170	Wilson, Partridge & Co.	27
		Warner, J. W. P. ...	22

D. B. John (D. B. John & Bros.), electrical engineer, &c., 8, Commercial Place, Pontycymmer, and Nanthir Stores, Nanthir Road, Blaengarw.—First and final dividend of 9¾d. in the £, payable at the Official Receiver's Office, 34, Park Place, Cardiff.

F. H. Graham, electrician, 14, Hilltop Avenue, Harehills, Leeds.—First meeting held October 24th, at the Official Receiver's office, 24, Lower Bond Street, Leeds. Public examination, November 12th, at the County Court House, Leeds.

G. C. Lazenby, wireless engineer, 29, Old Town Street, Plymouth.—Trustee, Mr. P. S. Booth, Kimberley House, Holborn Viaduct, E.C.1, released August 8th.

P. W. Witham, electrical engineer, 139, Bournemouth Road, Parkstone.—Trustee, Mr. F. G. Wheatley, 102, High Street, Poole, released August 12th.

K. P. J. Jolivard (K. Jolivard & Co.), electrical engineer, late of 66, Victoria Street, S.W.—Last day for proofs for dividend, November 2nd. Trustee, Mr. E. Parke, Official Receiver, Carey Street, W.C.

D. Brayshaw, electrician, 78, Granby Street, Liverpool.—Last day for proofs for dividend, October 30th. Trustee, Mr. J. Allcorn, Official Receiver, Government Buildings, Victoria Street, Liverpool.

H. A. Langlois (trading in co-partnership with D. T. Donovan as the London Electrical Co.), electrical engineer, 119, St. Mary Street, Cardiff.—Application for discharge to be heard December 3rd, at the Law Courts, Cardiff.

W. Ross, wireless engineer, 35, Bridge Street, Haverfordwest.—Trustee, Mr. H. W. Thomas, Official Receiver, 4, Queen Street, Carmarthen, released September 30th, 1929.

H. Milnes, (H. Milnes & Son) plumber and electrical engineer, 6, Trinity Street, Huddersfield.—Trustee, Mr. A. Pontefract, 6, New Street, Huddersfield, released August 2nd, 1929.

C. S. Hill (Sanderson Hill & Co.), electrical factor, Waltham Chambers, Waltham Street, Kingston-upon-Hull.—Trustee, Mr. W. B. Hall, National Provincial Chambers, Silver Street, Hull, released October 5th.

J. Cameroff, electrical engineer, 147, Spencer Place, Leeds.—Receiving order made October 11th, on debtor's own petition.

T. C. Cottrell, electrician, 31, Autumn Street, Burley Lodge Road, Leeds.—Receiving order made October 12th, on debtor's own petition.

C. W. Sands, electrical and wireless contractor, High Street, Kings Langley.—Receiving order October 9th on debtor's own petition. First meeting held October 22nd, at 29, Russell Square, W.C.; public examination November 27th at the Court House, St. Albans.

J. Turner, wireless dealer, 103a, Little Ilford Lane, Manor Park, E.12.—Receiving order made October 14th on debtor's own petition. First meeting to-day (Friday); public examination, November 19th, both at Carey Street, W.C.

P. G. Crump (Dales), wireless dealer, &c., 44, Wyle-cop, Shrewsbury.—Trustee, Mr. C. J. Pyke, Official Receiver, 22, Swan Hill, Shrewsbury, released October 4th.

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H. W. Beesley, motor, cycle and wireless engineer.—First and final dividend of 6s. 1¼d. in the £, payable October 25th at the Official Receiver's office, 37, Cornmarket Street, Oxford.

J. Littler, electrical and radio engineer, 9, Hoghton Street, Southport.—First dividend of 2s. 6d. in the £, payable October 25th at the office of the trustee, Mr. A. T. Eaves, 47, Mosley Street, Manchester. (This amended notice is substituted for that appearing in the *London Gazette* of October 11th, 1929.)

Company Liquidations.

Mawlite Electric Lamp Co., Ltd., 28, Belgrave Road, S.W.—A meeting of creditors was held on October 14th at the offices of the company, when the liquidator, Mr. S. E. Eastbury, presented a statement of affairs as at September 24th last, which disclosed liabilities to unsecured creditors of £1,146. There were preferential claims of £60 and a bank overdraft of £30. The amount due to the trade was £486, whilst there were cash creditors for £659. The only assets of the company were book debts estimated to realise £28 and a small amount of petty cash. The liquidator said that one of the directors of the company, a Major Mawson, had distrained in respect of rent and the stock and fixtures had been realised to satisfy that debt. The company had been in existence for about three years, the nominal capital being £200. Losses had been incurred from the commencement, which the liquidator said was mainly attributable to the heavy overhead expenses. A creditor said that the meeting was not valid as the Companies (Consolidation) Act had not been complied with. The creditors agreed and the liquidator intimated that he would call another meeting.

Stevens & Cole, Ltd., 46, Barking Road, Canning Town, Essex.—Under the compulsory liquidation of this company, which dealt in wireless equipment, gramophone records and accessories, accounts have been lodged showing liabilities of £2,497, against assets of £904, and a total deficiency of £1,743 with regard to contributories, the issued capital being £150. Mr. H. P. Naunton, Official Receiver, reports that the company was registered in June, 1928, with a nominal capital of £500 and took over three businesses in East India Dock Road and Barking Road, where Leonard Cole had traded as Stevens and Cole. The businesses of the company did not flourish, and on April 15th last a debenture for £150 was issued to Cole to secure a loan of that amount. A receiver was appointed on June 25th and he took possession of the assets. The failure is attributed to severe trade competition, depreciation of stock, and lack of experience by the directors. The liquidation is in the hands of the Official Receiver.

Electric Production Co., Ltd.—A meeting of members is called for November 14th, at the offices of Leonard, Dickinson and Co., 82, Victoria Street, S.W., to hear an account of the winding up from the liquidator, Mr. G. Dickinson.

American Radio Combine.

The formal announcement of the organisation of the General Motors Radio Corporation was issued by the executives of the General Motors Corporation and the Radio Corporation of America last week. The new concern will manufacture radio sets and develop sets for installation on motor cars made by General Motors. The agreement is between General Motors on the one hand, and the Radio Corporation and the American General Electric and Westinghouse Companies on the other. General Motors contributes $5,100,000 in cash, and the other group $4,900,000 and grants licences for all its patents covering radio, &c. The new corporation will be capitalised at $10,000,000 in preferred, and 1,000,000 no-par-value common shares, of which General Motors will own 51 per cent. and the radio group 49 per cent.—*Reuter* (New York).

Westinghouse Metal Rectifiers.

The Westinghouse Brake & Saxby Signal Co., Ltd., states that advices have been received that the United States Court has declared that the "Kuprox" rectifier is an infringement of the Grondahl patent, under which Westinghouse metal rectifiers are manufactured, and the Court has declared the patent valid. The company is the owner of the British rights in the patent.

Advertisement Correction.

We regret that a printer's error occurred in the advertisement of Messrs. Edwardes Bros. in our issues of October 11th and 18th (pp. 32 and 26 of the Advertisement Supplement, respectively). The size of cable in line 8 should have been 7/.044 and not 7/.064 as printed.

Important American-German Telephone Agreement.

The International Telephone and Telegraph Corporation announces that it has come to an agreement with the Allgemeine Elektricitäts Gesellschaft and the firm of Felten and Guilleaume for the establishment of a new German company which will acquire interests in German telephone manufacturing companies and assist in the development of their business. The new company will acquire immediately Mix & Genest, Ferdinand Schuchhardt A.G., and the Sud-deutsche Apparatfabrik G.m.b.H. The American company will place all its patent rights at the disposal of the new concern.—*Reuter* (New York).

In a pronouncement upon the subject last week, Herr C. F. von Siemens, head of the Siemens concerns, deprecated the penetration of foreign capital into German industry. He said that many leaders of the electro-technical industry had called in foreign aid because they thought that they could not weather the storm without it. While it might be necessary to obtain the support of foreign capital, it would be a mistake to allow it to seize control of German industry. He was confident that the latter would emerge successfully if it kept free of this control.

The 1929-30 Lighting Season.

Among the selling aids produced by the electric lamp manufacturers, one of the most attractive is the large showcard produced by the British Thomson-Houston Co., Ltd., which bears a reproduction of the familiar picture of the "Mazda" dancing girl with the title "Beauty Enriched by Light." Another device which is being supplied by the same company is a cardboard "cabinet" for the display of the simplified line of "Pearl" lamps; this has a pocket in the front for pamphlets. On another showcard particulars of "Mazda" lamps for various makes of motor vehicles are given.

The Edison Swan Electric Co., Ltd., has designed a cut-out window display for the use of retailers of "Royal Ediswan" lamps.

"A "Royal Ediswan" Window Display.

This takes the form of a house set in scenery of charming colours. The windows of the house are lighted as are the headlights of the car which is seen emerging from the garage in the accompanying illustration. The words "Royal Ediswan" are illuminated and continually change colour; no flashers are employed. The display is about 38 in. wide and 24 in. high.

British Cables for Dundee.

At last week's meeting of the Dundee Electricity Committee a tender for British cable at £5,796 was accepted. It was stated by the Convener that the difference between the British and foreign quotations was only about 8 per cent. When tenders were last considered there was a margin of 17 per cent.

Unemployment.

A further increase of 25,338 in the total number of registered unemployed was recorded for the week ended October 7th. At that date the total was 1,207,200, as compared with 1,181,862 on Sptember 30th, and 1,319,706 on October 8th, 1928.

Trade Announcements.

Mr. F. J. Serle, 10, East Reach, Taunton, Somerset, has opened new showrooms at 57, East Street, Taunton, where he is showing radio sets, components and "Fuller" batteries.

Mr. W. Moody has relinquished his position as manager of Messrs. C. Gilbert & Son, electrical and radio engineers, Marylebone.

In our last issue, in recording their change of address, we described Messrs. Harry Jones & Co. as electro-platers. While they do electro-plating, their primary business is the manufacture of electric lighting fittings.

New Distributors of Edison Storage Batteries, Ltd., have removed to permanent offices on the sixth floor from the temporary offices on the fourth floor, at their same address, Victoria House, Southampton Row, W.C.1. The telephone number is unchanged.

Accumulators of Woking (1928), Ltd., states that several exaggerated reports have appeared regarding the extent of damage caused by fire at its works on October 19th. Although a considerable amount of batteries for home and foreign railways were destroyed, the fire was entirely confined to one section of the assembly shop, and no part of the production side of the work has been affected. Arrangements have been made for assembling to go forward through other shops, and deliveries will be maintained with the minimum delay.

Continental Electrical Development.

In the course of the annual report of the Bank für Elektrische Unternehmungen, Zurich, which is the well-known Swiss investment company and promoter of electrical undertakings, the directors state that the steady development in the electricity supply industry continues undiminished without regard to political and economic fluctua-

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tions. In all countries the demand for electricity is steadily growing, and scarcely has a new works been put into operation than a number of new and still larger schemes are projected. The confidence of engineers and economists in the great possibilities also seems to be shared by the investing public, since of all securities electricity shares, &c., are the least affected by Stock Exchange reactions and continue to enjoy great popularity. It is to be desired, the report says, that this fully-justified tone for electrical undertakings should not be disturbed by exaggerations. At the recent annual meeting of the Bank it was stated, on behalf of the directors, that the financial situation of the Bank continues to be liquid, and that considerable funds are available for new transactions. The centre of gravity of the Bank's activity in 1928-29 was in Spain and France, while interesting possibilities have arisen in Italy.

A "Specials" Tug-of-War Cup.

The Magnet House Head Office special constables recently won the tug-of-war challenge cup for Special Constabulary teams of London business houses. The G.E.C. team defeated Gamage's in the first round and Shoolbred's in the final.

For Sale.

Blackburn Corporation Electricity Department has for disposal a number of second-hand d.c. amp.-hour meters by Ferranti and Chamberlain & Hookham. The West Central Merchandise Mart will sell by auction at York House, Southampton Row, W.C., on October 30th, lighting cables, electrical fittings, radio goods, rubber-covered wire, &c. (See our advertisement pages to-day.)

New Zealand's Electrical Imports.

The *Board of Trade Journal* shows that the imports of electrical equipment into New Zealand during the second quarter of this year was £513,632. Of this the United Kingdom accounted for £281,682, the United States for £111,399, Canada for £47,682, and Australia for £12,902.

German Electrical Exports to Russia.

Statistics published by the *Board of Trade Journal* show that during 1928 electro-technical products valued at 26,927,000 marks (about £1,346,000) were exported from Germany to Soviet Russia, as compared with 16,008,000 marks (£800,000) in 1927. The exports of electrical machines (including parts) had a value of 21,469,000 marks (£1,073,000) against 14,804,000 marks (£740,000) in 1927.

The Motor Show "Exide" Luncheon.

The annual luncheon given by the Chloride Electrical Storage Co., Ltd., on the occasion of the opening of the Motor Show took place at the Clarendon Restaurant on October 17th. Mr. D. P. Dunne, a director of the company, gave some hints on the care of batteries to be used or laid by, as the case may be, during the winter months. He animadverted on the slogan "Buy British," which would not help the sale of British cars in foreign countries and he doubted its effect in the Colonies so long as the British car was built "to a Home Government specification." In selling Exide batteries his company used the slogan "Buy Exide—it's the best." And he ventured to suggest for the car industry "Buy the best—it's British." Exide batteries were sold in important quantities in most European countries as well as in all other countries. Sales were initiated, not by advertising, but by invasion. Mr. Dunne welcomed the development of the British car abroad and said when and wherever it arrived it would find Exide already established and at its service.

New Catalogues and Lists.

Walsall Electrical Co., Ltd., 61, Bridge Street, Walsall.—An illustrated and priced leaflet of oil-immersed star-delta starters.

Messrs. Belling & Co., Bridge Works, Southbury Road, Enfield.—A very complete catalogue (pp. 72) of electric fires, cookers, water heaters and other domestic appliances. The list of the company's products is prefaced by some useful notes on the use and advantages of electrical appliances in the home.

Messrs. Henry Wallwork & Co., Ltd., Red Bank, Manchester.—Leaflet No. 569 drawing attention to the company's totally enclosed gearing and No. 102, describing variable-speed gear.

Vacuum Oil Co., Ltd., Caxton House, Westminster, S.W.1.—An illustrated brochure dealing in an interesting manner with the horizontal steam turbine for stationary plants.

Messrs. Siemens Bros. & Co., Ltd., Woolwich, S.E.18.—Publications describing the company's wireless and marine service, auto alarm device, auxiliary apparatus for ships, wireless direction finder, and short-wave transmitter (auxiliary) and receiver.

Cook Electric Co., 2,700 Southport Avenue, Chicago, U.S.A.—An illustrated leaflet outlining the advantages of the type X telephone terminal.

Messrs. Pritchett & Gold & E.P.S. Co., Ltd., 50, Grosvenor Gardens, S.W.1.—An attractive showcard of the company's closed top type of cell. The card is a very faithful reproduction of the actual cell.

D.P. Battery Co., Ltd., Bakewell, Derbyshire.—Two illustrated pamphlets advertising the "Kathanode" battery for omnibus lighting and in connection with totalisators.

Messrs. H. E. Ashdown (B'ham), Ltd., Aldridge Road, Perry Barr, Birmingham.—A leaflet illustrating the company's lampholders; also two folders drawing attention to Bakelite mouldings and lampholders.

Ever-Ready Co. (Great Britain), Ltd., Hercules Place, Holloway, N.7.—A trade list of portable electric flash lamps, refills and wireless batteries showing retail prices.

British Insulated Cables, Ltd., Prescot, Lancs.—Publications Nos. H. 118, P. 250, and P.F. 59, drawing attention, respectively, to multiple telephone cables for indoor use, "Prescot" a.c. meters, and B.I. aerial cable unions.

Philips Lamps, Ltd., Philips House, 145, Charing Cross Road, W.C.2.—Publication No. 214 L, giving particulars of daylight blue headlight lamps and "Duplo" anti-dazzle lamps.

Messrs. J. M. Doughty & Sons, Ltd., 214 to 222, St. John Street, Clerkenwell, E.C.1.—Two well-produced catalogues of the company's lighting fittings. Fully illustrated and priced.

Messrs. H. J. Baldwin & Co., Commercial Union Buildings, Cheapside, Nottingham.—A comprehensive loose leaf catalogue divided into three sections, *viz.*, cable covers, ducts, and troughing. A thumb index is provided for each section, and the catalogue is fully illustrated.

Carron Company, Carron, Falkirk.—A showcard illustrating a lady using a Carron electric iron, who is obviously finding the task of ironing a pleasurable one. Also a copy of the company's new season fire catalogue, containing illustrations, dimensions, and prices of electric fires.

Messrs. Varley (Oliver Pell Control, Ltd.), Kingsway House, W.C.—A catalogue of radio receivers, gramophones, pick-ups, and auto-arms. The catalogue is divided into five sections, and in addition to an alphabetical index, includes a thumb index. Illustrated and priced. Also an instructional book, explaining the construction and operation of radio receivers, gramophones, &c.

Edison Swan Electric Co., Ltd., 123-5, Queen Victoria Street, E.C.4.—A heating and cooking catalogue containing illustrations and prices of the company's domestic appliances.

Messrs. Fredk. Thomas & Co., Ltd., 189 and 191, Drummond Street, Hampstead Road, N.W.1.—A catalogue (pp. 89) illustrating the company's wide range of lighting fixtures. Also two booklets dealing with "Efteelite" lighting unit fittings and modern electrical fittings. Illustrated and priced.

Messrs. Ferranti, Ltd., Hollinwood, Lancs.—Several publications illustrating the company's radio components. Priced.

Ceag, Ltd., Barnsley, Yorks.—A brochure describing "Ceag" cap lamps for use in mines, and bulbs for miners' lamps.

Messrs. J. G. Statter & Co., Queen Anne's Chambers, Westminster, S.W.1.—Two leaflets dealing with air circuit breakers, including maintenance instructions.

"Typerlite" Company, 86, Cannon Street, E.C.4.—An illustrated price list of "Typerlite" fittings.

Henderson Wireless & Electrical Service, 54, Queen's Road, Brighton.—A net trade price list of electrical wiring supplies.

Edison Swan Electric Co., Ltd., 123-5, Queen Victoria Street, E.C.4.—Three illustrated and priced leaflets dealing with Tungar battery chargers.

Wandsworth Electrical Manufacturing Co., Ltd., Kenyon Street, Birmingham.—An illustrated pocket price list of the company's electrical accessories.

Lunken Co., Ltd., 35, Great Dover Street, S.E.1.—A pamphlet drawing attention to the "Piccolo" hand tachometer.

Petters, Ltd., Westland Works, Yeovil.—A well-produced catalogue describing the company's atomic Diesel stationary type oil engines. Some excellent illustrations are included.

Mr. S. O. Bowker, 37, Tenby Street, Birmingham.—An illustrated booklet dealing with the "Tenby" wiring system.

Revo Electric Co., Ltd., Britannia Works, Tividale, Tipton.—A leaflet advertising the "Superspeed" boiling plate.

Superlamp, Ltd., 92 and 94, Paul Street, E.C.2.—An illustrated list (pp. 65) of electrical material, motors, telephones and domestic appliances. Priced.

Messrs. Henry Jenkins & Sons, Ltd., Unity Works, Vittoria Street, Birmingham.—A list of electric lighting fittings. Illustrated and priced.

Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester.—Publication No. 7250/4, fully illustrated, dealing with high-voltage apparatus, covering 33,000, 66,000, and 132,000-V. installations in various parts of the world. Also the descriptive leaflets Nos. 40/1-1 and 40/2-1, dealing, respectively, with large induction motors and high speed induction motors.

Messrs. Lane & Girvan, Ltd., Caledonia Stove and Electrical Works, Bonnybridge, nr. Glasgow.—A catalogue giving illustrated particulars of "Caledonia" cookers, boiling plates, heaters, fires, &c. Priced.

Messrs. J. J. Eastick & Sons, 118, Bunhill Row, E.C.—The October number of "Eelex Radio Bulletin," contains matter relating chiefly to exhibits shown at the recent National Radio Exhibition. It also includes a news section of activities in the radio industry and a list of radio sets and components, with prices and illustrations.

The Timber Market.

Our Timber Trade Correspondent reports that the softwood section still shows great activity, both as regards imports from Russia, Finland and Sweden, and also demand, the latter

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having been good since last February. There has been an increase lately in fresh mahogany log and other shipments to the United Kingdom, but supplies this year are still on the light side, with values firm. More foreign sawn hardwoods, especially from the United States, arrived in September, but imports have been low this year; stocks are large, with prices fairly firm. Good English oak, ash and other hardwoods, as well as Empire varieties, are to be preferred to many of the foreign woods.

Book Notices.

"*Journal* of the Institution of Electrical Engineers." Vol. LXVII, No. 394, October, 1929. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

"The Henley Telegraph" for September not only contains more matter than usual, its price has been reduced from 6d. to 2d. It is as ever interesting, amusing and instructive almost as much to others as to members of Henley's staff.

"Faraday House Journal," Vol. XIII, No. 4. London: Faraday House College.—Once again the Michaelmas term number of this house organ contains a large number of articles on many subjects.

Private Arrangements.

E. M. Parsons, electrician and wireless dealer, 57, Paragon Street, and 58, Prince's Avenue, Hull.—A meeting of creditors was held on October 11th at the offices of Messrs. Dawson and Lancaster, Hull, when a statement of affairs was submitted which showed liabilities of £4,562, and net assets of £1,101, leaving a deficiency of £3,461. It was reported that the unsecured creditors' claims included cash creditors for £2,695, who had agreed to withdraw their claims in the event of the estate being wound up under a deed of assignment. The creditors resolved that subject to the cash creditors withdrawing their claims, the deed of assignment executed by the debtor in favour of Mr. J. J. Campbell as trustee should be confirmed. The following are creditors:—

	£		£
Ashcroft, E.	200	General Electric Co., Ltd.	75
Chloride Electrical Storage Co., Ltd. ...	64	Houghton - Butcher, Ltd.	75
D.P. Battery Co., Ltd.	76	Hacquoil & Co. ...	636
Etherington, H., and Sons	142	Kettlewell, Son & Co., Ltd.	93
Edison Swan Electric Co., Ltd.	59	Liverpool Electric Cable Co., Ltd. ...	56
Electric Lamp Factors, Ltd.	70	Ninnes Holmestower...	656
Fifoot, F.	1,202	Taylor, J., & Son ...	64
Gilbert & Co.	106		

Kingston Electrical Exhibition.

As a means of further increasing the domestic load, the Kingston-on-Thames Corporation Electricity Department recently held an electrical exhibition at the Baths Hall. Despite the limited space available, an attractive display was arranged, and every appliance that was likely to be of interest to the housewife and of use in the home was to be seen. The previous exhibition was held some five years ago, so that visitors were confronted with apparatus showing a considerable advance in design and decorative effect. In opening the exhibition, the Mayor said that the demand for electricity was increasing, but they were handicapped, as they had no showroom with which to attract the domestic consumer. He ventured to prophesy, however, that they would possess one in the not distant future. The companies represented at the show included the following: Jackson Electric Stove Co., Ltd.; Berry's Electric (1928), Ltd.; Stearn Electric Co., Ltd.; Thames Electric Co., Ltd.; Metro-Vick Supplies; Drake & Gorham Wholesale, Ltd.; Bentalls, Ltd.; General Electric Co., Ltd.; Manor Electric Oven & Fire Co.; Frigidaire, Ltd.; W. H. Gaze & Sons, Ltd.; Singer Sewing Machine Co., Ltd.; C. Lathe & Co., Ltd.; and Thornton and Stimpson.

Prices of Materials.

Messrs. F. Smith & Co. report, October 22nd: Copper (electrolytic) bars, no change; ditto ditto sheets, no change; ditto ditto wire rods, £90, 10s. dec.; ditto ditto h.c. wire, no change; silicium bronze wire, 1s. 2d., ½d. dec.

Messrs. James & Shakespeare report, October 22nd: No change in the price of copper bars (best selected), sheet and rod; English pig lead, £24 10s., 5s. dec.

Messrs. Edward Till & Co. report, October 22nd: India-rubber, Para fine, 9¾d., ½d. dec.

In their letter dated October 19th, Messrs. James Forster and Co. reported that the lead market was quiet again last week, and prices, following the tendency in other metals, became easier. Arrivals this month have not been too plentiful, with the result that "spot" lead is scarce and commands a premium, but with ample supplies expected in November, this shortage should be only temporary, particularly as consumption is already showing a tendency to decrease. Under present conditions higher prices than the present are not justified; in fact, had it not been for the control exercised by the Producers' Association during the past few weeks, lower prices would undoubtedly have been seen. The Board of Trade returns for September show imports of 25,127 tons and exports of 2,355 tons, leaving 22,772 tons for home consumption.

Lighting and Power Notes.

Ayrshire.—Year's Working.—The report of Mr. W. C. Bexon, engineer and general manager of the Ayrshire Electricity Board, for the year ended May 15th last shows a total revenue of £234,678, as compared with £231,015 in the preceding year. The working expenditure totalled £106,733, as against £94,058, leaving a gross profit of £127,945 (£136,957). A balance of £3,078 from the previous year added to the gross profit made a total of £131,023 available, and after providing for capital and other charges there was a net surplus of £3,289. The capital expenditure during the year amounted to £154,572, and included £47,977 for boiler plant, £42,999 for underground mains, and £29,871 for overhead transmission lines. The total now spent on the undertaking stands at £1,767,247. The sales of electricity increased from 37,312,534 to 38,569,499 kWh, and the maximum supply demanded from 18,700 to 20,400 kW. The average price obtained per kWh fell from 1.480d. to 1.460d. Extensions were made to accommodate two 50,000-lb. boilers, but these were not ready to be put into commission during the year. The total length of underground cable laid during the year, exclusive of services, was 20 miles, while 24½ miles of transmission line were erected.

Barnsley.—Mains Extensions.—The Corporation Electricity Committee is to extend mains to housing estates at a cost of £6,330.

Bicester.—Inauguration of Supply.—The ceremony of switching-on the town's electricity supply was performed recently by Mrs. Ruck-Keene, wife of Admiral Ruck-Keene, at the Wessex Electricity Co.'s sub-station in the Market Square. The cost of the electricity scheme so far has amounted to £20,000.

Bradford.—Year's Working.—We have received from Mr. Thomas Roles, city electrical engineer, a copy of the abstract of accounts of the Electricity Department together with the report of the Electricity Committee for the financial year ended March 31st last. The total revenue amounted to £574,159, as compared with £556,338 in the preceding year, and the working expenditure was £336,850, as against £317,184, leaving a gross profit of £237,309 (£239,154). Capital and other charges amounted to £223,553, and there was a net surplus of £13,756, as compared with £31,229 in 1927-28. A contribution of £21,000 was made to the district rate and £6,656 was devoted to other purposes. The balance was met by the appropriation of £13,900 from the depreciation, &c., account. The capital expenditure during the year totalled £204,399, the chief item being £186,637 for mains and services. The sales of electricity increased from 86,758,306 to 91,086,929 kWh. The maximum supply demanded fell from 41,700 to 41,000 kW, and the average price obtained per kWh from 1.447d. to 1.423d. Steady progress was made throughout the year on the erection of the buildings and plant in connection with the scheme for the installation of e.h.p. steam raising and generating plant.

Bristol.—Year's Working.—We have received from Mr. H. Faraday Proctor, chief engineer and general manager, a copy of the annual report, together with a statement of accounts, of the Corporation Electricity Department for the twelve months ended March 31st last. The total revenue amounted to £572,439, as compared with £536,910 in 1927-28, while the working expenditure was £279,529, as against £261,166. The gross profit totalled £292,910 (£275,744), to which was added income from other sources, making a total of £307,561 available. After providing for interest on loans, income tax, &c., there was a net surplus of £65,874, as compared with £117,991 in the preceding year. The capital expenditure during the year amounted to £731,264, and included £122,186 for buildings and £143,350 for culverts at the Portishead works and £132,614 for mains. The electrical energy sold increased from 84,123,978 to 93,441,031 kWh and the maximum supply demanded from 38,363 to 40,220 kVA. The average price obtained per kWh fell from 1.45d. to 1.37d. The first instalment of the Portishead works is almost completed and will be available for use shortly. The second instalment has been put in hand, the works comprising one 50,000-kW turbo-alternator, two boilers, and auxiliary plant.

Burton-on-Trent.—Electricity Supply Developments.—The Town Council has decided to spend £35,000 on electricity supply developments, chiefly for the purpose of extending the system to Uttoxeter, *via* Tutbury and Marchington.

Buxton.—New Electricity Charge.—The Corporation has adopted the following two-part "all-in" tariff, in addition to its flat rate system of charge: (*a*) A fixed charge based on the ratable value as follows:—Premises assessed at £60 and under, 20 per cent. on the net ratable value, with a minimum of £4; premises assessed at over £60, 20 per cent. of the net ratable value on the first £60 and 15 per cent. over that amount. (*b*) A "unit" charge of ½d. for all energy consumed for all purposes.

Canada.—Hydro-Electric Development.—The Hydro-Electric Power Commission of Ontario has purchased the power rights of the Ottawa River at Chatta Falls for $750,000 (£150,000). The potential capacity of the falls is 250,000 h.p., involving an aggregate development expenditure of $7,500,000, the Provinces of Quebec and Ontario acting in co-operation.—*Reuter* (Toronto).

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Croydon.—Year's Working.—The report of Mr. Alex. C. Cramb, borough electrical engineer, on the working of the electricity undertaking for the year ended March 31st last, shows a total revenue of £299,693, as compared with £277,703 in the preceding year. Working expenses increased from £106,073 to £108,559, and other expenditure charged to revenue from £42,992 to £45,553, leaving a gross profit of £145,581 (£128,638). Capital and other charges absorbed £91,177, and there was a net surplus of £54,403, as compared with £48,989 in 1927-28. The capital expenditure during the year amounted to £69,329 and included £39,518 for mains and £18,275 for machinery and plant. The sales of electricity increased from 31,914,634 to 39,368,221 kWh, and the maximum supply demanded from 16,200 to 19,000 kW. The average price obtained per kWh fell from 2.078d. to 1.815d.

Glasgow.—New Plant.—The Corporation Electricity Committee has decided to install automatic control gear at the Byres Road and Kelvinside sub-stations, at a total estimated cost of £1,600, and additional switchgear at various premises, at a cost of £1,145.

The Committee has authorised the manager to arrange for the installation of automatic control gear at the Byres Road and Kelvinside sub-stations at a total estimated cost of £1,600.

Mains Extensions.—The Committee recommends that distributing mains be laid at a cost of £3,000.

Progress During September.—Under the Corporation Electricity Department's scheme 668 houses were wired in September making the total to date 16,701, while 186 hired appliances were installed bringing the total to 18,610.

School Heating.—The experimental heating of schools by electricity is to be continued in Glasgow for a further period of one year.

The Clyde Valley Co.—The Clyde Valley Electrical Power Company is extending its cables in order to give a supply of electricity to Lenzie district. The work will be completed early next spring.

Guildford.—Electricity Supply.—The Corporation Electricity Committee is to provide a supply of electricity to Gooserye, Albury Heath, Farley Green and Little London at a cost of £5,782.

Mains Extensions.—The Committee has decided to extend mains in West Clandon and Burpham at a cost of £3,336.

Hereford.—Transfer of Undertaking.—The Corporation has applied to the Electricity Commissioners for consent to transfer its undertaking to the Shropshire, Worcestershire and Staffordshire Electric Power Co.

Liverpool.—Special Order.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Corporation to supply electricity in the rural district of Sefton and parts of the rural district of Whiston.

London.—Islington.—The London and Home Counties Joint Electricity Authority has informed the Borough Council Joint Electricity and Lighting and Finance Committees that it is unable to agree to giving a supplemental supply of electricity, and has put forward an alternative offer to supply the whole of the Council's requirements. The committee recommends the Council to approve the scheme generally.

St. Pancras.—The Borough Council Electricity and Public Lighting Committee has recommended that the Central Electricity Board be informed that the Council is prepared to give a temporary supply of electricity upon the following terms:—(*a*) The Board to pay 25s. per annum per kW taken at the time of the maximum demand upon the Council's generation station with a minimum of £8,000 during the first year of supply. (*b*) The Board to pay in addition a running charge of 0.196d. per kWh, this charge to be variable in proportion to any variation in the cost of coal from 20s. per ton delivered. (*c*) The agreement to be for a period of one year from the date when the supply is first taken from the Board, with provision for its continuance from year to year until the generating station is operated under the South-East England Electricity Scheme, and subject to a satisfactory adjustment of the minimum kW charge of £8,000. (*d*) The power factor of the supply taken shall be maintained at not less than 85 per cent. lagging.

The Committee has also recommended the extension of mains, at an estimated cost of £1,264, and the conversion of 80 gas lamps to electricity, at an estimated cost of £356.

Loughborough.—Electricity Supply Scheme.—The Town Council has approved a scheme for the supply of electricity to the parishes of Hathern and Thorpe Acre and Lishley Grange. The cost of the cables and transformers is estimated at £5,700.

Louth.—Electricity Scheme.—The Town Council has received sanction to a loan of £22,043 for carrying out an electricity scheme under which energy will be received in bulk from Grimsby.

Manchester.—Progress during July and August.—During the months of July and August the Corporation electricity undertaking recorded an increase in connections of 3,669 kW, bringing the total up to 393,945 kW. The number of applications received for supply, including those for additional supplies, amounted to 2,098 and represented a total of 4,490 kW. The number of hired cookers connected increased by 122, making the total number of cookers actually connected 5,524. Applications for the hire of cookers totalled 178. Three new sub-stations were put into commission and additional plant was installed in five existing sub-stations. The change-over from d.c. to a.c. had been completed in the cases of 8,260 consumers up to September 13th, and sanction had been given and work was in progress involving 916 consumers.

New Zealand.—Christchurch.—The report of the Municipal Electricity Department (manager: Mr. E. Hitchcock) for the year ended March 31st last shows a total revenue of £211,495, as compared with £194,037 in the preceding year. From this sum the following charges had to met: Working expenses, £50,581; purchase of bulk supply of electricity. £70,344; interest, £26,638; depreciation, £30,351. There remained a net surplus of £33,580, as against £22,517 in 1927-28. The revenue from sales of appliances, installations. &c., amounted to £55,243, and the expenditure was £51,302, leaving a profit of £3,941. The electrical energy purchased from the Lake Coleridge power undertaking totalled 45,787,949 kWh, as compared with 39,757,621 kWh, while the number of kWh sold increased from 34,894,754 to 40,470,596. An additional unit is to be installed at the Lake Coleridge power station, which will raise its capacity from 27,000 to 34,500 kW. The supply from the Waikaki development will, it is hoped, be available for the winter load of 1932.

Wellington.—We have received from Mr. M. Cable, general manager of the Corporation Electricity Department, a copy of the annual report and statement of accounts of the undertaking for the year ended March 31st last. The total revenue amounted to £325,823, as compared with £339,980, while the total working expenses were £137,463, as against £144,352. The profit was £188,360 (£195,628), and to it was added £521 bank interest, making a total of £188.881 available. Of this, interest on loans absorbed £29,722, sinking fund £7,429, renewal fund £18,460, and reserve fund £18,460. There remained a net surplus of £114,810, as compared with £124,038 in the preceding year. The capital expenditure during the year amounted to £48,266, the chief item being £29,971 for l.p. mains. The electrical energy sold for all purposes increased from 30,212,973 to 33,223,536 kWh, and the maximum supply demanded from 12,910 to 13,682 kW. The average revenue per kWh rose from 2.09d. to 2.33d.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

Taunton.—Power: Up to 4,000 kWh per quarter, from 1½d. to 1¼d. per kWh; above 4,000 kWh per quarter, from 1¼d. to 1d.; above 32,000 kWh per annum, from 1d. to ¾d. per kWh. It is stated by the borough electrical engineer that the Corporation electricity undertaking's figure of 2.39 lb. of coal per kWh generated is believed to be the lowest in Great Britain when compared with entirely steam-driven stations with an output of only 3,518,106 kWh.

West Wiltshire.—*West Wilts Electric Light and Power Co., Ltd.*—Maximum demand rate for hotels, clubs, institutions, &c., from 2½d. to 2d. per kWh. Residential subscription rate: 2½d. for a certain number of kWh per quarter and 2d. beyond, reduced to 2d. per kWh. The company is introducing a reduced shop-lighting contract rate.

Rotherham.—New Electricity Charge.—At a recent meeting of the Corporation Electricity Committee the engineer reported on the advisability of adopting an alternative two-rate tariff. The committee decided to recommend that for h.p. electricity supplied in bulk and used for any required purpose, the purchaser shall have the option of adopting, as an alternative to the existing flat rate scale of charges, a two-rate tariff as follows: a fixed charge of £4 per annum per kVA of maximum demand, plus ¼d. per kWh, this rate to be subject to the signing of an agreement embodying a clause adjusting the price per kWh according to the price of coal and providing for a minimum annual payment, the total charge as above defined to be subject under present prices to an increase of 10 per cent.

South-East Lancashire Electricity Advisory Board.—Special Order.—The Engineering Advisory Committee has recommended the Board to support the application made by the Hazel Grove and Bramhall Urban District Council for a Special Order authorising it to supply electricity in the parish of Woodford and part of the parish of Poynton, in the rural district of Macclesfield.

Operating Statistics.—For the quarter ended June last, the total energy delivered to the feeders was 240,741,973 kWh, as compared with 221,400,347 kWh for the corresponding quarter of the preceding year, and the cost per kWh was .242d., as against .257d.

Transmission Line.—The Board has been recommended to approve the establishment of a main transmission line between Hazel Grove and Buxton by the Trent Valley and High Peak Electricity Co., Ltd., the estimated cost of the work being £29,349.

The minutes of the Engineering Advisory Committee have been approved by the Board.

Southend-on-Sea.—Inquiry.—Col. T. C. Ekin will hold an inquiry on November 6th into the application of the Town Council for a loan of £66,000 for the installation of generating

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plant and accessories in place of the existing steam generators and Diesel plant.

Loan Sanctioned.—The Town Council has received sanction to a further loan of £25,623 for land, buildings, and mains required in connection with the change-over in certain parts of the borough.

Stoke-on-Trent.—Sub-Station Equipment.—The Corporation Electricity Committee has voted £4,400 for the purpose of equipping the sub-station proposed to be erected in Kingsway, Stoke, and for works in connection with the supply of electricity in the surrounding area.

New Mains.—The Committee has decided to replace mains in Queen Street and Swan Square, at a cost of £1,700.

Tilbury.—Loan.—The Urban District Council has applied for sanction to a loan of £4,309, the balance of the cost of carrying out its electricity scheme.

Torquay.—Electricity Supply.—The Corporation Electricity Committee has adopted a scheme, estimated to cost £2,915, for the supply of electricity to Stoke Gabriel.

United States.—Electrical Developments.—The first unit of the steam-electric plant of the Duke Power Co. at Riverbend, near Mount Holly, N.C., was recently put into operation. It is stated by *Power* that the scheme involves expenditure aggregating several millions of dollars, and that the completion of the plant, which operates with coal as fuel, adds approximately 110,000 kW to the available supply of the Duke company. The generating equipment of the first unit will include two turbo-generators, each with a capacity of 55,000 kW. The plant is the first of several units which it is proposed to erect there as the demand for power produced by this company increase. The ultimate capacity of the plant will be 440,000 kW.

Adding 50,000 h.p. to the electric system of Puget Sound Power and Light Co., Seattle, Wash., the first unit of the Shuffleton steam plant was completed recently. The new plant is situated at the south end of Lake Washington, near Renton, Wash. Through a decision of the company made last spring, work has already been started on the construction of a second unit, which will bring the ultimate capacity of the plant up to 100,000 h.p. The whole project involves an expenditure of $7,000,000.

Walton-on-Thames.—Purchase of Cookers.—The Urban District Council has authorised the expenditure of a further £500 on the purchase of cookers.

Wellington (Somerset).—Electricity Scheme.—The Urban District Council has given its consent to an electricity scheme submitted by Whitehall Securities Corporation, Ltd., which has taken over the undertaking of the Wellington District Electricity Co., Ltd. It is proposed to lay a main transmission line from Exeter, where energy will be taken in bulk from the Corporation's works. The distribution lines will be of the overhead type, and it is hoped that a supply will be available within a year.

Worksop.—Electricity Supply.—Intimation has been received from the Electricity Commissioners that they are disposed to grant the Order sought by the Urban District Council for the extension of its existing area of supply to Whitwell, rather than that the parish should be served by a small and separate undertaking.

Tramway and Railway Notes.

Bristol.—The Tramway Purchase Option.—At a meeting held last week, the City Council decided, by 51 votes to 31, against exercising its option to purchase the undertaking of the Bristol Tramways and Carriage Co., Ltd., for a sum estimated at £1,000,000.

Chatham.—Tramway Abandonment.—The Ministry of Transport has authorised the abandonment of the Chatham and District Light Railways Co.'s tramway system as from September 30th, 1930.

Croydon.—Year's Working.—The accounts of the Corporation Tramways Department (manager: Mr. T. B. Goodyer) for the twelve months ended March 31st last record an increase in the total revenue from £110,521 to £122,779. Working expenses amounted to £116,533, as against £123,448 in the preceding year, leaving a gross profit of £6,246, as compared with a gross deficit of £12,927. Loan and other charges totalled £38,324, and there was a net deficiency of £32,078, as against £50,880 in 1927-28. The capital expenditure during the year amounted to £41,902, the chief item being £38,096 for cars. The car mileage increased from 2,253,762 to 2,283,608, and the number of passengers carried from 18,670,001 to 19,570,164.

Glasgow.—The Pinkston Station.—Tenders have now been received for the reconditioning of the boiler plant at the Pinkston power station of the Corporation Tramways Department. The estimated cost of the reconstruction work is over £200,000. The offers will be submitted to the Committee for approval at an early meeting.

Leeds.—New Tramcars.—The Corporation is to build 150 new tramcars at a cost of £348,000.

London.—The Traffic Situation.—The Underground Group of Companies is engaged upon a careful review of the London traffic situation with a view to submitting proposals to the Minister of Transport for extending and improving the present system. No definite decision can be reached until the whole problem has been carefully considered. An extension of the Piccadilly Railway north of Finsbury Park is the most urgent problem, and the directors are giving special attention to it, since an early decision is necessary if a Bill is to be promoted in the next session of Parliament.

New Zealand.—Wellington.—The accounts of the Corporation Tramway Department (general manager: Mr. M. Cable) for the year ended March 31st last record a total revenue of £451,181 and a working expenditure of £336,448, leaving a gross profit of £114,733. The figures for the preceding year were: Income, £449,930, working expenses, £332,467, gross profit, £117,463. From the gross profit the following charges had to be met: loss on motor-'buses, £13,109; interest on loans, £39,848; sinking fund, £9,314; renewal fund, £21,377; reserve fund, £21,377. There remained a net surplus of £9,708, as compared with £14,367 in 1927-28. The capital expenditure during the year amounted to £54,227, including £10,996 for permanent way, £18,926 for buildings and fixtures, and £10,947 for tramcars. The number of passengers carried increased from 46,832,341 to 47,051,933, but the car mileage fell from 4,164,820 to 4,159,125. The average receipts per car mile rose from 25.92d. to 26.03d.

Salford.—Year's Working.—We have received from Mr. J. S. D. Moffet, general manager and engineer, a statement of accounts of the Corporation's tramway undertaking for the year ended March 31st last. The total income amounted to £458,628 and the working expenses were £374,682, leaving a gross profit of £83,946, to which was added income from investments, &c., making a total of £95,154 available. After providing for loan charges (£70,054), rents of lines (£11,070), and Church Street property (£178), there remained a net surplus of £13,851.

Southend-on-Sea.—Railless Cars.—The Town Council has adopted a recommendation by the Light Railways and Transport Committee to extend the railless-car system in the borough, and also to run motor-'buses outside the town. Five new railless-car routes will be constructed, and a sum of £92,010 is to be expended on the provision of overhead equipment and the purchase of 35 additional railless cars.

Tramway Abandonment.—The Ministry of Transport has authorised the Corporation to abandon its tramway system.

The Great Western Railway.—Carriage Lighting.—A further programme for substituting electric lighting in gas-lighted coaches has been adopted by the G.W.R. The proposal provides for the completion of the equipment of all corridor stock on the company's system, and also all non-corridor coaches containing first-class compartments built since 1900.

The Southern Railway.—Derailment.—The derailment of an electric train at Borough Market Junction, near London Bridge station, at 6.48 a.m. on October 16th caused a blockage of the lines between London Bridge and Charing Cross and London Bridge and Cannon Street. Places as far away as Dorking, Wallington, Croydon, Caterham, Woolwich, and Dartford were affected, and an emergency service had to be run till noon, when normal working was resumed.

United States.—New York.—A plan is to be placed before the Board of Transportation for the construction of a tube railway between Coney Island and the Bronx, upon which trains will be capable of a speed of 60 m.p.h., with stops about five miles apart.

Telegraph and Telephone Notes.

China.—Radio-telegraphy.—A wireless telegraph service has been inaugurated between Wuhutsui and Fuchou, just north of the Kwantung leased territory, chiefly for military service.

Long-distance Telephony.—In North Manchuria, the Chinese long-distance telephone systems comprise the Heilungkiang, the Mukden-Kirin-Heilungkiang, the Harbin-Manchouli-Suihua, and the C.E.R. systems, each being an independent unit. Director Chiang, of the North-Eastern Electricity Administration, Mukden, has made Chen-chiachen, superintendent of the Harbin telephone office additionally director of the North Manchuria long-distance telephone office. The Harbin office has been made the general office, the other offices becoming its branches. Connections are to be effected with the local telephone service.

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Colombia.—Radio Stations.—The Government has authorised the International Telephone and Telegraph Corporation in South America to construct a radio station at Bogotá and two additional coast stations, one on the Atlantic Ocean and the other on the Pacific. The concession covers international wireless telephony and telegraph services, a regular service from ship-to-shore and shore-to-ship, and communication to and from aeroplanes.—*Reuter's Trade Service* (Bogotá).

Costa Rica.—Communication Services.—There are now 2,176 miles of telegraph wires in operation in Costa Rica, or 4.6 miles for each 1,000 of the population. The number of telephone instruments in use in the Republic is 18,875, or 2.6 for each 1,000 inhabitants.

Irish Free State.—Automatic Telephony.—In 1922 some 104 exchanges and 552 call offices were in operation; local calls numbered 10,000,000 and trunk calls 77,700. By the close of 1928 there were 678 exchanges and 1,165 call offices in operation, while the number of local calls had grown to 19,265,000, and the number of trunk calls to 177,450. Dublin has now 5,000 automatic telephones in use, and arrangements have been made by the Post Office to have 6,175 installed with 5,575 extensions in the course of the next few months. This increase in automatic telephones was decided on after subscribers with a lengthy experience of the system had been consulted on whether the whole of Dublin should be turned over to automatic working; 60 per cent. voted, of which 90 per cent. were in favour. In 1925 there was only one trunk circuit to Cork; now there are three. The telephone service to England has doubled, and about 15 calls are now put through between Dublin and Liverpool, or London, in a normally busy hour.

Russia.—Radio-Telephony.—The first wireless telephone in the Soviet Union, connecting Moscow with Sverdlovsk, a distance of over 1,000 miles, is now being tested, and will be put into operation at the end of the month.—*Reuter's* (Moscow).

Spain.—Transoceanic Radio-communication.—The King of Spain, General Primo De Rivera, and Mr. G. Marconi inaugurated on October 21st, direct radio communication between Spain and the U.S.A., Brazil, Argentina, and Cuba.

Swedish Telephones.—South America.—A number of important new concessions for the installation of Swedish automatic telephone exchanges are reported by the L.M. Ericsson Telephone Company, of Stockholm. In the town of Mendoza and vicinity, in Argentine, a new Ericsson telephone system with an all-automatic exchange, at present comprising 4,260 lines, but with the total capacity of 50,000 lines, was recently opened by the governor of the province of Mendoza. In the town of Juiz de Fora, in Brazil, the Ericsson Co. will install another all-automatic telephone exchange with a total capacity of 9,000 lines, which will be the most modern installation of its kind in Brazil.

New Zealand.—The towns of Whangarei and Marton, in New Zealand, have both decided to introduce the Ericsson automatic system. The exchanges will be constructed for total capacities of 1,000 and 2,000 lines, respectively.

Switzerland.—Telephony.—The Swiss Post and Telegraph Authorities have included a sum of £30,940 in their annual budget for the establishment of a large new telephone exchange in Zurich. It will at first be equipped for 10,000 connections, capable, however, of subsequent extension to 20,000.

The Telephone Service.—Increased Traffic.—The total number of telephone stations in the British Post Office system on July 31st, 1929, the latest date for which statistics are available, was 1,794,424, an increase of 7,559 on the total at the end of the previous month. London's share was 641,660 stations, an increase of 2,776 for the month, of which 154,943 were residence-rate subscribers (month's increase 835) and 5,671 were call-office stations, including 1,383 street kiosks. The provinces claim 1,152,764, the increase for the month being 4,783; of them 243,647 were residence-rate subscribers (month's increase 4,783) and 22,006 were call-office stations, including 5,468 street kiosks. Ten new rural railway stations were connected with telephone exchange systems, giving a total of 1,173.

Radio Notes.

Cuba.—Legislation.—The Chief of the Radio Bureau of the Cuban Department of Communications has submitted to the secretary of that department a comprehensive report on the way in which radio broadcasting and receiving stations should be established in future on the island of Cuba. Owing to the excessive number of radio telephone and broadcasting stations on the Isle of Cuba, it is necessary to make new allocation of wavelengths as well as to limit the time in which the various stations may operate during the day, so as to avoid interference among them. The power, wavelength, and site of each station have been registered in the Radio Bureau, and the improvements will be enforced as soon as the Secretary of the Department of Communications has had an opportunity of studying the project.

Holland.—Proposed New Station.—The Workers' Broadcast Society (V.A.R.A.) has recently had an interview with the Minister of Waterstaat, who is responsible for the control of wireless in Holland, with a view to obtaining permission to erect its own station. Another point discussed, says *World Radio*, was that of allowing all transmitting associations to be represented on the Radio Council.

Line Relaying.—Brussels Conference.—A brief, but very businesslike, conference on line relaying was held at Brussels on October 8th, 9th and 10th, between delegates of the British, Belgian, and German broadcasting authorities, together with representatives of the Post Offices of those countries. Mr. Marcel van Soust de Borkenfeldt, of Radio-Belgique, was chosen as president, and the delegates met first in two committees, for technical and programme matters, respectively, and then for the discussion of subjects common to both. It will be recalled that the East-Central European countries, *viz.*, Czecho-Slovakia, Austria, Hungary, Poland, and Germany, some time ago carried into effect a scheme for the systematic exchange of programmes by line, and the Brussels Conference is expected by *World-Radio* to be the beginning of a similar linkage for North-Western Europe.

Regional Transmitters.—Northern Plant Contract.—The B.B.C. announces that a contract has been signed for the building of the north regional broadcasting transmitter at Moorside Edge, near Huddersfield. A number of Midland and London contractors were invited to compete, and the successful firm is the Anglo-Scottish Construction Co., Ltd., which was responsible for the erection of the building at the London regional transmitter at Brookman's Park. The work will be carried out under the direction and to the specification of the civil engineer to the British Broadcasting Corporation, and will start immediately. The building will take about a year to complete, and the lay-out will be very similar to that of Brookman's Park.

London Station Change-over.—At 3.30 p.m. on October 21st, the new regional transmitter of the B.B.C. at Brookman's Park took over the whole service for the London area, and the Oxford Street (2LO) station ceased to function.

Russia.—Development.—All broadcasting is controlled by the Radio Department of the Commissariat of the People for Posts and Telegraphs. Commercial concerns are allowed to operate their own transmitters, but the technical management of such stations is controlled by the same authority. There are at present 63 transmitting stations in Russia, but the number of registered listeners is comparatively small, because registration is only compulsory from the month when a district station of from 12 to 20 kW begins to operate. According to *World-Radio*, there are in towns 282,045 registered listeners, and in the country districts 44,240. The total number of listeners, however, is estimated at eight millions. Registered public loud-speaker sets in towns number 9,792, and in the country 6,533, which number does not include those in streets, squares, and public gardens. In the larger towns public loud-speaker systems are installed in such a way that every set can also feed special loud-speakers installed in the private houses around.

Engineering Education in America.

Mr. W. Jackson, M.Sc., informs us that the committee on education of the American Institute of Electrical Engineers states, in its annual report, that the continued rapid increase in scientific knowledge and in the diversity and complexity of engineering applications and engineering responsibilities, makes the present four-year engineering college course a less and less adequate preparation for effective engineering work.

Very few teachers and engineers in America are, however, in favour of meeting the situation by requiring *all* engineering students to remain at college for a fifth or sixth year. Before increasing the length of the engineering course for all students, the engineering profession proposes to encourage the comparatively few graduates of the four-year engineering course who are possessed of the requisite interest, ability, and financial means, to continue in residence by enrolling in the graduate schools, and to encourage the majority, who will enter at once upon their engineering apprenticeships, to continue their educational efforts in a more systematic manner and to a more definite end than at present.

The committee suggests that the local sections of the Institute, particularly in the industrial centres where the engineering colleges are located, should each appoint a committee on education, the duty of which shall be to canvass the needs of the engineers of the district, particularly of the younger engineers, and to bring them to the attention of the college administrations, industrial managements, and engineering authorities in the districts. It is thought that a fully-developed programme of post-graduate education will mean a large expansion of the work of the engineering colleges, and that it will play an important part in the development of engineering teachers. It will afford greater opportunities to determine the adequacy, the relative importance, and the real significance of the principles and methods taught to undergraduates. It will also make teaching more attractive to a wider range of engineers by making it possible for men in teaching to have closer contact with engineering practice.

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Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—Melbourne.—November 27th. City Council. 6,600-V, 3-phase switchgear. (B.X. 5708.)*
December 10th. Posts and Telegraphs Department. Switchboard keys and parts. (B.X. 5776.)* Electric lamps, lamp caps, and lamp sockets for telephony purposes. (B.X. 5783.)*
December 17th. Telephone fuses, heat coils, and protectors. (B.X. 5784.)* Loading-coil pots. (B.X. 5785.)* Secondary batteries. (B.X. 5777.)*
November 27th. Victorian Government Railways. Automatic oil switches. (B.X. 5735.)* Indication transformers for railway signalling, with a no-load ratio of 100/6 V. (B.X. 5737.)*
March 30th. D.c. neutral relays for power-signalling purposes. (B.X. 5793.)*
December 9th.—State Electricity Commission of Victoria. 3,000-kVA transformers and spares. (B.X. 5775.)*

Ayr.—October 31st. Northern District Committee. Electric lighting at housing schemes. Particulars from District Offices, Kilwinning.

Bridgend.—November 18th. Mid-Glamorgan Water Board. Pumping station and ancillary works at Schwyll, Ewenny, near Bridgend. Electrical transformers, switchboard, meters, &c. Electric lighting, two centrifugal pumps, heating apparatus, electrical depth transmitters on various reservoirs, with cables and electric lines connecting with the pump house. Specifications from Messrs. Thomas & Morgan & Partners, Pontypridd.

Canada.—Toronto.—November 5th. Department of Works. One 10-million gallon centrifugal pump and electric motor complete with bed-plate, switchboard and accessories. (A.X. 8703.)*

Chile.—Santiago.—November 14th. Chilean State Supply Department. Telegraph material. (B.X. 5746.)*

Derby.—November 4th. Derbyshire County Council. Electric lighting installation at Bretby Hall Hospital, near Burton-on-Trent. Messrs. Martin & Martin and T. H. Ward, 106, Colmore Row, Birmingham. (Deposit £1 1s.)

Egypt.—Cairo.—November 19th. Ministry of the Interior. One Diesel-electric generating set for the Manfalout power station. (B.X. 5720.)*
November 30th. Diesel engine-driven electric lighting installation at Abou-Tig (Assiut Province). (B.X. 5791.)*

Glasgow.—October 28th. Corporation Lighting Department. Electric cable, steel poles, lanterns, and cast-iron bases for street lighting. Specifications, &c., from Inspector of Lighting, 20, Trongate.

India.—Delhi.—India Stores Department. November 12th. Battery charging motor-generators and oil switch. (B.X. 5774.)*
November 14th. Crude-oil engine-driven d.c. generating set and a motor-generator set, with switchgear, for the Military Engineering Services, Razmak. (B.X. 5744.)*
October 28th. House service meters for 12 months. (B.X. 5749.)*
November 18th. Two 20-kW oil-driven d.c. generators, water-softening plant, and overhead travelling crane. (B.X. 5757.)*

London.—Central Electricity Board.—November 9th. Supply, delivery, and erection of 33,000-V overhead transmission lines in South Lincolnshire. (September 27th.)
Metropolitan Asylums Board.—October 30th. Installation of central battery telephone system at South-Western Fever Hospital, London Road, Stockwell, S.W. (See this issue.)

New Zealand.—Wellington.—Post and Telegraph Department. November 18th. Resistance spools. (B.X. 5716.)*
October 29th. Telephone cable. (B.X. 5788.)*
November 19th. Telephone transformers. (B.X. 5718.)* Automatic wall and table telephones. (B.X. 5717.)*
March 11th. Public Works Department. 110-kV switchgear for interconnecting auto-transformers for the Waikato power scheme. (B.X. 5797.)* Switchgear and controlling equipment for Timaru. (B.X. 5798.)* 66-kV switchgear and protective system for Lyttleton, Lake Coleridge scheme. (B.X. 5796.)*

Smethwick.—Education Committee. Electric heating of Uplands School, shortly to be erected in two blocks. (See this issue.)

South Africa.—Johannesburg.—City Council. October 31st. Three-phase and single-phase outdoor transformers. (B.X. 5736.)*

Wakefield.—October 28th. West Riding Education Committee. Installation of electric light in the Whitwood Mining and Technical School. Education Officer, County Hall, Wakefield.

Wolverhampton.—November 15th. West Midlands Joint Electricity Authority. Two 6,600-kVA, two 1,200-kVA, and two 150-kVA transformers for Ironbridge power station. (See this issue.)

* Further particulars can be obtained at the department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Arbroath.—Board of Guardians. Accepted:—
Electric lighting of the Infirmary extension (£635).—Edmiston, Brown & Co., Ltd., Glasgow.

Australia.—Broken Hill.—North Broken Hill, Ltd., Broken Hill South, Ltd., Zinc Corporation.
Equipment for the central power station to be erected at Broken Hill to supply electricity and compressed air to the companies' mines:—
Six sets of 3,000-h.p. Diesel-driven electric generators and four sets of 1,200-h.p. Diesel-driven air compressors. The Diesel engines are to be supplied by Sulzer Bros. and the generators by the British Thomson-Houston Co., Ltd.
Diesel engines for compressors, switchgear, and accessories.—Australian General Electric Co., Ltd. (Diesel engines by Mirrlees, Bickerton & Day, Ltd.; air compressors by Belliss & Morcom, Ltd.)
Melbourne.—Postmaster-General's Department.
Underground and aerial cable (£62,028).—British Insulated Cables, Ltd.
Telephone switches (£2,637).—British General Electric Co., Ltd.
Secondary batteries. — Automatic Telephones, Ltd. (£3,070); Coates & Co. Pty., Ltd. (£616); T. K. Steames & Son (£374).
Carrier power boards and associated equipment.—Metropolitan Switchgear Pty., Ltd. (£1,981); McKenzie and Holland (Aust.) Pty., Ltd. (£955).
—*Tenders.*

Glasgow.—Electricity Committee. Recommended:—
Thirteen rotary convertors, reconstructed (£21,350).—Metropolitan-Vickers Electrical Co., Ltd. Five ditto (£11,428).—Bruce Peebles & Co., Ltd. Two ditto (£1,386).—English Electric Co., Ltd.
New and reconstructed rotary-convertor plant (£16,148).—British Thomson-Houston Co., Ltd.
Two rectifiers (£2,594).—Hewittic Electric Co., Ltd.
Re-winding alternator (£9,200).—C. A. Parsons & Co., Ltd.
One transformer (£495).—Ferranti, Ltd.
20,000-V cable (£304).—Callender's Cable and Construction Co., Ltd.
5,000 meters, reconditioned (£4,187).—Chamberlain and Hookham, Ltd.; Ferranti, Ltd.; Edison Swan Electric Co., Ltd.; and Metropolitan-Vickers Electrical Co., Ltd.
3,800 electric fires.—Belling & Co., Ltd.
50 time switches.—Venner Time Switches, Ltd.

Douglas (I. of M.).—Markets Committee. Accepted:—
Electric lighting at abattoir.—Lawton & Co.

Dundee.—Electricity Committee. Accepted:—
Cables (£5,796).—Derby Cables, Ltd.

Egypt. — Cairo — Gabbary power house extensions.—The Egyptian State Railways have received 20 British and Continental tenders for the extensions to the Gabbary power house. The lowest price quoted was £E63,347 by the Ateliers de Constructions Electriques de Charleroi, and the highest, £E102,290, by Krupps. The lowest British tender was that of the English Electric Co., Ltd., at £E64,865. The Metropolitan-Vickers Electrical Co., Ltd., quoted £E69,802 and the General Electric Co., Ltd., £E71,326.—*Reuter's Trade Service* (Cairo).

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Government Contracts.—The following contracts were placed by the various Government Departments during September, 1929:—

ADMIRALTY CONTRACT AND PURCHASE DEPARTMENT.

Battery gear.—Chloride Electrical Storage Co., Ltd.
Junction boxes.—Engineering and Lighting Equipment Co., Ltd.
Electric cable.—Croydon Cable Works, Itd.; Pirelli-General Cable Works Ltd.
Electric capstan.—Cowans, Sheldon & Co., Ltd.
Air compressor.—Reavell & Co., Ltd.
Electric crane.—Cowans, Sheldon & Co., Ltd.
Ship ventilating fan.—Electro Dynamic Construction Co., Ltd.; James Keith & Blackman Co., Ltd.; Mawdsley's, Ltd.; Veritys, Ltd.
Electrical installations.—Johnson & Phillips, Ltd.
Electric lamps.—General Electric Co., Ltd.
Valves (wireless).—General Electric Co., Ltd.; Edison Swan Electric Co., Ltd.
Electric winches.—Clarke, Chapman & Co., Ltd.

WAR OFFICE.

Maconite wiring system.—Macintosh Cable Co., Ltd.
Electric meters.—Measurement, Ltd.; General Electric Co., Ltd.
Valves, w/t.—General Electric Co., Ltd.
Wireless-telegraph sets.—Radio Instruments, Ltd.; Marconi's Wireless Telegraph Co., Ltd.
Steam turbine generating set and switchboard.—Greenwood & Batley, Ltd.

AIR MINISTRY.

Internal wiring (Boscombe Down).—S. Dixon & Son, Ltd.
Cable.—General Electric Co., Ltd.
Fuse boxes.—D. H. Bonnella & Son, Ltd.
Receivers.—H. W. Sullivan, Ltd.
Switches.—English Electric Co., Ltd.; Metropolitan-Vickers Electrical Export Co., Ltd.
Transmitters.—Gambrell Bros., Ltd.
Transmitters and receivers.—Siemens Bros. & Co., Ltd.

H.M. OFFICE OF WORKS.

Wiring (Welwyn Garden City).—R. Langston Jones and Co.
National Physical Laboratory switchgear.—English Electric Co., Ltd.

POST OFFICE.

Telegraph apparatus.—Creed & Co., Ltd.
Telephone apparatus.—Ericsson Telephones, Ltd.; International Electric Co., Ltd.; Standard Telephones and Cables, Ltd.; Telephone Manufacturing Co., Ltd.
Battery-charging sets.—Stuart Turner, Ltd.
Battery boxes.—Ericsson Telephones, Ltd.
Cable.—British Insulated Cables, Ltd.; Connolly's (Blackley), Ltd.; W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.
Joint-box castings.—General Foundry and Engineering Co., Ltd.
Cable drums.—British Insulated Cables, Ltd.
Ducts.—Albion Clay Co., Ltd.; Donington Sanitary Pipe and Firebrick Co., Ltd.; Doulton & Co., Ltd.; Hepworth Iron Co., Ltd.; J. Jamieson & Son, Ltd.; G. Jennings; Jas. Oakes & Co. (Riddings Colleries),) Ltd.; Oates & Green, Ltd.; J. Place & Sons, Ltd.; Standard Brick and Terra Cotta Co., Ltd.; Stanley Bros. and Co., Ltd.; Sutton & Co. (Overseal), Ltd.
Dynamotors.—W. Jones & Co.
Ebonite.—General Electric Co., Ltd.; India Rubber, Gutta Percha & Telegraph Works Co., Ltd.
Thermionic valves.—General Electric Co., Ltd.; Standard Telephones & Cables, Ltd.
Batteries (Blackburn telephone exchange).—Chloride Electrical Storage Co., Ltd.
Electric lighting (Paddington district post office).—Alpha Manufacturing and Electrical Co., Ltd.
Radio equipment (London repeater station).—Standard Telephones and Cables, Ltd.
Telephone exchange equipment.—G. Clark & Son, Ltd., Millwall Docks, E.14: Relay Automatic Telephone Co., Ltd. North (London) Terminus (W.C.), Paddington, Wembley, Hounslow, Lee Green, Ravenbourne, and New Cross: Automatic Telephone Manufacturing Co., Ltd. Rochdale: Standard Telephones and Cables, Ltd. Scotstoun (Glasgow): Ericsson Telephones, Ltd. Sub-contractors: Crompton Parkinson, Ltd., for motor generators and ringing machines; Chloride Electrical Storage Co., Ltd., for batteries. Hindhead and Whitehall: Siemens Bros. & Co., Ltd. Sub-contractors: English Electric Co., Ltd., for charging machines; Crompton Parkinson, Ltd., for ringing machines; Hart Accumulator Co., Ltd., for batteries.

CROWN AGENTS FOR THE COLONIES.

Battery.—D.P. Battery Co., Ltd.
Cable.—W. T. Henley's Telegraph Works Co., Ltd.
Conductors.—British Insulated Cables, Ltd.
Electric lamps.—General Electric Co., Ltd.
Switchgear.—English Electric Co., Ltd.; Metropolitan-Vickers Electrical Co., Ltd.
Telephones.—Ericsson Telephones, Ltd.

Liverpool.—City Council. Recommended:—
Main and auxiliary switchgear for the new Clarence Dock generating station (£72,651).—British Thomson-Houston Co., Ltd.

London.—STEPNEY.—Electricity Supply Committee. Recommended:—
Pipework for Limehouse generating station extensions (£7,802).—Aiton & Co., Ltd.
Distribution boxes (£237).—W. Lucy & Co., Ltd.
Condenser tubes (£385).—Yorkshire Copper Works, Ltd.
Solder (£341).—Locke, Lancaster and W. W. & R. Johnston & Sons, Ltd.
STOKE NEWINGTON.—Electricity Committee.
Rotary converting plant and switchgear (£8,325).—General Electric Co., Ltd.
E.h.p. cable (£2,400 approx.).—W. T. Henley's Telegraph Works Co, Ltd.
Annual contracts:—
L.p. cables.—Croydon Cable Works, Ltd.
Installation work in private premises under the Council's wiring scheme.—Andstro (A.A.) Electric (18s. per point) (for 4 to 6 points wired in lead-covered cable system).
ST. PANCRAS.—Contracts and Stores Committee.
Cable (£1,723).—Standard Telephones and Cables, Ltd.
SHOREDITCH.—Electricity Committee.
Converting equipment for Hearn Street sub-station:—
Mercury-vapour rectifiers (£8,967).—Hewittic Electric Co., Ltd. (Recommended.)

Lanarkshire.—County Council. Accepted:—
Electrical work at the new Glasgow offices (£1,449).—Johnston, Park & Co., Ltd.

Louth.—Town Council. Accepted:—
Cable and street works (£12,818).—Power Lines, Ltd.
Sub-station equipment (£1,312).—Crompton Parkinson, Ltd.

Stafford.—Corporation. Accepted:—
Overhead cable to the Stafford Timber Co.'s works (£292); transformer (£120).—English Electric Co., Ltd.

Stoke-on-Trent.—Hospital Committee. Accepted:—
Electrical services at new cubicle block and garage of isolation hospital (£216).—Barnett & Soans.
Electric lighting installation at Stallington Hall (£370).—Painter & Madew.
Stores Purchase Committee. Accepted:—
Electric lamps.—Blackburn, Starling & Co.; Barnett and Soans; and Robinson & Hands Electric Co., Ltd.

Forthcoming Events.

North-East Coast Institution of Engineers & Shipbuilders.—Friday, October 25th. Literary and Philosophical Society, Newcastle-on-Tyne. 6.30 p.m. Annual General Meeting.

Institution of Railway Signal Engineers.—Friday, October 25th. Criterion Restaurant. Annual Dinner.

Birmingham Electric Club.—Friday, October 25th. Grand Hotel. 7 p.m. "Motor Users and the Frequency Change." Mr. T. A. Windibank.

Physical Society.—Friday, October 25th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

Junior Institution of Engineers.—Friday, October 25th. 39, Victoria Street, S.W. 7.30 p.m. "Electric Welding as applied to Bridges and other Structures." Mr. H. Bruff.

Faraday House Old Students' Association.—Friday, October 26th. Savoy Hotel, 6.30 for 7 p.m. Annual Dinner.

Institution of Electrical Engineers.—INFORMAL MEETING.—Monday, October 28th. Institution, Victoria Embankment, W.C. 7 p.m. "Systematic Research by Industrial Undertakings." Opened by the President.

(Meter and Instrument Section).—Friday, November 1st. Institution, London, W.C. 7 p.m. Inaugural address by the Chairman, Mr. E. W. Hill.

(North-Midland Centre). — Tuesday, October 29th. Hotel Metropole, Leeds. 7 p.m. Address by the Chairman, Mr. T. Roles.

(West Wales (Swansea) Sub-Centre).—Friday, October 25th. Corporation Showrooms, Swansea. 6 p.m. Address by the Chairman, Mr. J. W. Burr.

(North-Eastern Students' Section).—Friday, October 25th. Armstrong College. 7.15 p.m. Address on the work of the British Electrical Development Association.

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Association of British Radio Societies.—Monday, October 28th. Albert Hall, Manchester. 7.30 p.m. "The Ideal Loud-Speaker." Dr. N. W. McLachlan.

County Borough of West Ham Electricity Department.—Monday, October 28th. Holborn Restaurant, Holborn, W.C. 7 p.m. Dinner—Farewell to Mr. Purse, Welcome to Mr. Townley.

Association of Supervising Electrical Engineers.—Tuesday, October 29th. Lighting Service Bureau, Savoy Place. "Various Applications of Indirect Lighting with Special Reference to Public Buildings." Mr. W. J. Jones.

Institution of Mechanical Engineers.—Friday, November 1st. Institution, Storey's Gate, S.W. 6 p.m. Thomas Hawksley Lecture. "Critical Relations between Water and Steam." Prof. H. L. Callendar.

Electrical Power Engineers' Association (West Yorkshire Section).—Saturday, November 2nd. Great Northern Hotel, Leeds. 5.30 for 6 p.m. Annual Dinner.

Royal Society of Arts.—Wednesday, November 6th. John Street, Adelphi, W.C. 8.30 p.m. "Fifty Years of Electrical Science and Industry." Mr. Ll. B. Atkinson.

Salford Technical & Engineering Association.—Saturday, November 2nd. Royal Technical College. 7 p.m. Short Papers in competition for the gold medal awarded by Mr. W. O. Larmuth.

Notes.

Breaches of Electricity Regulations.

At the Kidderminster Petty Sessions recently, the West Midland Sugar Co., Ltd., was summoned for an alleged breach of the Electricity Regulations relating to factories.

It was stated by the prosecution that an employé at the company's works, Foley Park, received a shock and sustained injuries while using a portable lamp with an exposed metal part which was not earthed.

Witnesses for the defence stated that all the portable lamps used in the factory were of the proper kind and the one in question was in use without the company's knowledge.

The Bench held that the case had been proved and imposed a fine of £10 with 19s. costs.

The hearing was resumed at Lambeth Police Court on October 16th of a summons against the County of London Electric Supply Co., Ltd., for an alleged breach of the Electricity Regulations under the Factory and Workshops Act, 1901. As we reported in our issue of September 13th (p. 446) the case arose from injuries sustained by an employé named Morgan who came into contact with some unprotected "live" apparatus in a transformer station at Rye Lane, Peckham.

The prosecution maintained that the apparatus in question should have been screened or made "dead." The company said that Morgan was an experienced man. Instructions had been given for the terminals to be screened and the part on which Morgan was actually working was "dead."

The Magistrate said that experienced people often needed protection on account of over-confidence. He found the case proved and imposed a fine of £35 with £15 15s. costs.

The Huddersfield magistrates last week fined the Huddersfield Corporation £10 for having allowed cleaning to be done to a switchboard at the Corporation electricity works without the board having been rendered dead. The case arose out of an accident to a youth while cleaning the board. The prosecution contended that the youth, Sykes, was certain that he was not told that the cubicles were alive when he was put on to clean the switchboard with a handbrush. Mr. W. Brown, Divisional Inspector of Factories, said he thought Sykes's brush must have established contact with one of the links of the cubicles. In answer to Mr. Spencer, for the Corporation, witness said that the regulations laid it down that the board must be dead before even the top or back could be cleaned. Mr. Spencer said that that would mean leaving a section of the town without electricity for a time. Mr. Saywell, for the Director of Public Prosecutions, replied that commercial practicability did not matter. Mr. Spencer contended that Sykes undertook work which he was not asked to perform, being told to clean the back of the switchboard only. He argued that the top and back of the switchboard, which were insulated, and could not possibly be dangerous, were not part of the board. Mr. J. W. Turner, borough electrical engineer, said that cubicles on the switchboard were cleaned out once a year. The job was a serious one, as it meant that a section of the town was cut off for a time. The weekly cleaning of the switchboard was performed by a trained man without the board being made dead.

W. E. Highfield Shield Competition.

The results of the 1929 competition for the W. E. Highfield Shield and prizes recently held under the auspices of the Association of Supervising Electrical Engineers are now to hand as follows:

Members' Section: 1st Prize (value £5 5s.), presented by British Insulated Cables, Ltd.; Mr. D. J. Williams, for his paper "Public Lighting"; 2nd Prize (£3 3s.), presented by Messrs. Berry's Electric (1928), Ltd.; Mr. E. E. Gammon for his paper "Light: Dominating Influence of Window Display"; 3rd Prize (£2 2s.), presented by Messrs. Turner Bros. Asbestos Co., Ltd.; Mr. G. Kirk for his paper "Advancement in the Application of Electricity."

Associates' Section: 1st Prize (value £4 4s.), presented by Messrs. Ferranti, Ltd.; Mr. F. Anderson for his paper "Control Boards for Super-power Stations"; 2nd Prize (£2 2s.), presented by the Editor of "Electricity"; Mr. A. Simpson for his paper "Advantages of Interpoles on d.c. Generators."

Mr. D. J. Williams, as winner of the first prize in the Members' Section, also wins the Highfield Shield which he holds for one year.

Appointments Vacant.

Electrical engineer (£480) for the Government of Nigeria Public Works Department. Mains assistant for York Corporation. Full-time lecturer in the electrical engineering section of the Engineering Department of Halifax Technical College. Engine and boiler fitter at the Surrey County Sanatorium, Milford. Jointer linesman for Kettering Urban District Council Assistant mains engineer for Bexley Urban District Council. (See our advertisement pages to-day.)

The Union of the Scottish Churches.

The recent decision of two important Scottish churches to unite was historic, and in celebration of the event the headquarters of the two churches in Edinburgh (the Tolbooth Established Church of Scotland Assembly Hall and the United Free Church Assembly Hall) were floodlighted. The latter

The Union of the Scottish Churches.

building, which is situated on the mound facing Princes Street, is shown in the accompanying illustration. The spire seen in the centre is that of the other building, which is some distance away. The photograph, taken from Princes Street, thus appears to combine the two headquarters in physical union.

"Light's Golden Jubilee."

President Hoover, Mr. Henry Ford, and a group of notable people, assembled in Detroit, Michigan, on October 21st., to pay tribute to Mr. Thomas Edison, and to take part in the elaborate ceremonies commemorating "Light's Golden Jubilee" on the fiftieth anniversary of Mr. T. A. Edison's contribution to the perfection of the incandescent electric lamp. To provide an appropriate setting for the celebration, Mr. Ford had erected near his workshops a full-sized replica of Mr. Edison's nineteenth century workshop, where, fifty years ago, the inventor produced his first electric lamp bulb. At a dinner President Hoover addressed the nation through 150 wireless stations, and dedicated the Edison Institute of Technology, constructed by Mr. Ford in honour of his friend. Among those present at the dinner were Mr. Owen Young, General Dawes, and Mme. Curie. The perfection of the incandescent electric bulb cannot fairly be placed to the sole credit of Mr. Edison. It is clear that the actual discovery of using a carbon filament in an exhausted glass vessel was male as long ago as 1860 by an English inventor, the late Sir Joseph Swan.

The Leon Gaster Memorial Fund.

Nearly two years have elapsed since the death of Mr. Leon Gaster, founder, vice-president and honorary secretary of the Illuminating Engineering Society. To commemorate the great services which he rendered to the Society and to illuminating engineering during nearly 20 years, the Council has accordingly

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decided to institute a Leon Gaster Memorial Fund and it is proposed that a fund of not less than £200 shall be collected, the interest on which shall be devoted primarily to the establishment of a premium to be awarded annually for the best contribution from a subscribing member of the Society on any aspect of illuminating engineering which is submitted to the Society during the year. Promises of contributions from 5s. to £5 5s. have already been received and it should be possible to establish a memorial which will worthily commemorate Mr. Leon Gaster's lasting services to illuminating engineering. Contributions should be sent to the honorary secretary (Mr. J. S. Dow, 32, Victoria Street, London, S.W.1).

E.P.E.A. Annual Dinner.

The eleventh annual dinner given by the Southern Division of the Electrical Power Engineers' Association to the members of the National Executive Council was held at the Hotel Cecil, London, on October 19th, under the chairmanship of Mr. E. Rendell Ingham. About 480 members and guests were present.

After the loyal toast, the health of the Association was proposed by Mr. Frank Hodges, J.P., of the Central Electricity Board, who made an "impassioned speech" regarding recent agitations against the proposals of the Central Electricity Board. Everybody was anxious to preserve rural beauty, and there were organisations formed for that purpose. There were, however, individuals also who hid behind such organisations and exploited them for personal ends. The Board had not hitherto raised its voice in the matter, because it awaited the decision of the Judicial Court set up under the Act of 1926. That court had sat for ten days under an inspector appointed by the Minister of Transport; the inspector made his report in favour of the Board's scheme. One would have thought that that would have ended the agitation; nevertheless, attempts were being made to upset the Court's decision. If another body, such as a trade union, had, after the issue of an arbitration award, struck for its original demands, public opinion would describe such conduct as dastardly and unpatriotic. Town dwellers were not the people who tried to prevent the countrymen from having electricity, but private interests which were concerned with private amenities only. With regard to Battersea, science would not be found wanting to prevent the damage to property that some feared.

Mr. T. D. Martin, A.M.I.E.E., president of the Association, responding, compared present methods of purchasing electricity to the Chinaman's plan (in Charles Lamb's essay) of burning down a house to obtain roast pig. He hoped the invention of "grid iron" would make possible a more efficient production than that under which 67 per cent. or so, even under the best conditions, was all the consumer got out of every pound of coal. Regarding the progress of the Association, its health was shown by its ability to reform from within in conformity with evolution from without. The success of its Whitley Council was shown by the fact that only once had arbitration been necessary. There would be fewer generating stations on account of the activities of the Central Electricity Board, to whom he commended the suggestion that the cost of compensation to displaced officials should be borne, not by the small undertakings, but by the industry as a whole. The toast of "Our Guests" was proposed by the chairman.

Mr. F. W. Purse, M.I.E.E. (chief engineer, London and Home Counties Joint Electricity Authority), briefly replied. He referred to the keen interest taken in their work by the younger members of the profession, whom he advised to "drive their business and not to let their business drive them."

Mr. A. V. Sendall (senior vice-president), in an amusing speech, formally presented Mr. A. C Stewart, B.Sc., the immediate past-president, with a cabinet gramophone, and Mrs. Stewart with an emerald and diamond ring. Mr. Stewart, in expressing his thanks, said that, as the father of the National Executive Council—he had served nine years—he considered that the future of the Association was in the right hands. Mr. W. S. Jeffery then presented Mr. J. N. Waite (city electrical engineer, Hull) with an illuminated address and a lucky gold pig; the reason for the latter gift is too long a story for insertion here. He reminded members that Mr. Waite would have been president, but for his promotion and the exacting nature of his new duties. Mr. Waite had also been the initiator of the technical side of the Association's activities, and had done a very great deal towards giving the *Electrical Power Engineer* its position as a technical journal.

A just tribute was paid by the chairman to the excellent arrangements made by Mr. P. Gordon Hieatt for a most enjoyable evening. This was the eighth successive annual dinner organised by Mr. Hieatt. The programme of entertainment was once more arranged by Mr. Sydney Warwick, and the high standard of previous years was well maintained.

The New Oldham Power Station.

The new electricity generating station of Oldham Corporation at Slacks Valley—a selected station under the "Grid" scheme—was formally opened on October 16th by Councillor Charles Hardman, J.P., chairman of the Oldham Corporation Electricity Committee, in the presence of a company of some 200 guests. The occasion was graced by the presence of Sir Andrew Duncan, M.A., LLB.., chairman of the Central Electricity Board, who started the plant, and Mr. Archibald Page, chief engineer to that Board. The new station, which has cost a quarter of a million pounds, has a present generating capacity of 37,500 kilowatts, and is designed for an ultimate capacity of 150,000 kilowatts.

Councillor Hardman, in opening the main door of the works, said the committee had been faced with considerable difficulty in finding a site for the works owing to water requirements. The estimate for the building and completion of the works had been £15 per kilowatt installed, but it had only cost actually £13 per kilowatt installed. If the cotton trade improved as it had been doing lately, he thought they could safely proceed with the installation of a further 50,000 kilowatts, which would bring down the cost to the neighbourhood of £10 per kilowatt installed.

At a luncheon gathering, Sir Andrew Duncan proposed a toast to the Oldham Electricity Undertaking, and said when the station was completed it would be one of the biggest in the country. Apart from Oldham's domestic needs, the works had become part of the link of Agecroft-Chadderton-Hartshead which, it was hoped, would serve the north-western area under the Central Electricity Board's scheme.

In supporting the toast, Alderman Frith referred to the saving in coal consumption as between the old plant and the new at Oldham. The cost of the coal used per unit generated in 1911 was 7.66d., and to-day was 2.30d.

Councillor Hardman, responding, reviewed the history of development of the Oldham electricity undertaking. In the year ended March last it sold 48½ million units, the revenue was £240,000, and a profit of £26,000.

Sir John Brooke, Electricity Commissioner, responded to the toast of "Our Guests."

Councillor Shepherd, giving the toast of "The Contractors," mentioned that the whole of the new plant was British manufacture.

Sir Philip Nash, chairman of Metropolitan-Vickers, Ltd., responding on behalf of his firm and of the sub-contractors—Messrs. Babcock & Wilcox; the Brightside Foundry; the Premier Cooler & Engineering Co.; and Ferguson, Pailin, Ltd.—handed to Mrs. Hardman a silver tea and coffee service in appreciation of the contractors' happy relationships with her husband, the chairman of the Oldham Electricity Committee.

Alderman W. E. Freeman proposed "The Engineers," and said Mr. Blackmore, the consulting engineer, and Mr. Ogden, the borough electrical engineer, worked together like David and Jonathan. Alderman Freeman presented, on behalf of the committee, a silver tray to Mr. Ogden.

Mr. Blackmore and Mr. Ogden briefly responded.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Hammersmith Borough Council Establishment Committee recommends that Mr. G. L. Law, deputy engineer and manager of the Barnes U.D.C. electricity undertaking, be appointed to the position of deputy borough electrical engineer and manager of the Hammersmith Borough Council electricity undertaking at a commencing salary of £800 per annum. Sixty applications were received.

The committee recommends that a payment of £169 be made to Mr. R. H. Paterson, borough electrical engineer, in recognition of his services as acting borough electrical engineer following the death of his predecessor (Mr. F. Hill) until July 17th, 1929.

Madame Curie, who with her husband discovered radium 20 years ago, recently sailed from France to America on the *Ile de France*.

Mr. S. E. Monkhouse, M.I.E.E., has been appointed chief assistant to the general manager of the Newcastle-upon-Tyne Electric Supply Co., Ltd. Mr. Monkhouse, who has been with the company for 25 years, has, during the past few years, acted as chief of the company's Power Department. Mr. E. H. E. Woodward, M.I.E.E., who has been with the company for over 20 years, has been appointed technical assistant to the general manager.

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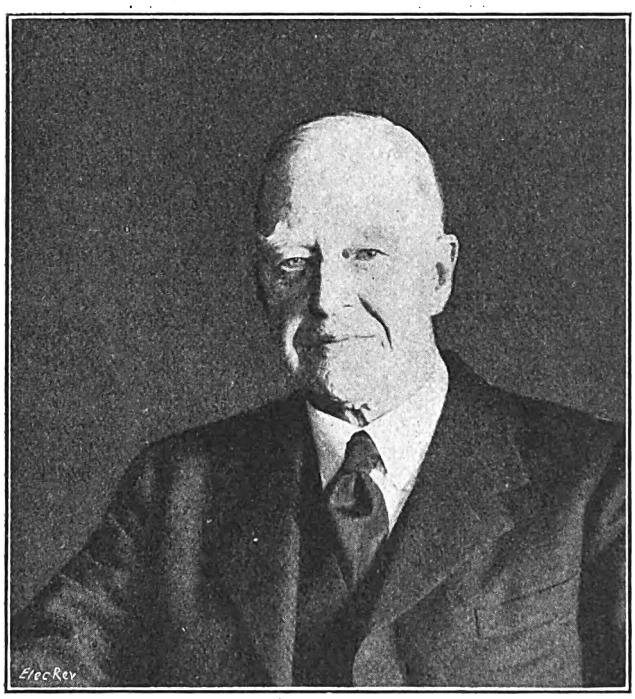
The Southend-on-Sea Town Council has placed on record its high appreciation of the services rendered to the borough by Mr. Robert Birkett, borough electrical engineer for over 24 years, and expressing a hope for his restoration to health, and for his happiness in his retirement. The resolution is to be inscribed on vellum and presented to Mr. Birkett.

Mr. Wm. Crawford, managing director of the Z Electric Lamp & Supplies Co., Ltd., states that as and from November 1st, Mr. H. A. Spreadbury will act with him as joint managing director of the company.

On Monday last the Plymouth Corporation Tramways and Transport Committee appointed Capt. Clement Jackson general manager and engineer of its undertaking, in succession to Mr. H. P. Stokes, who is taking up another appointment. Capt. Jackson is at present acting in a similar capacity at Oldham.

The Bedford Corporation Electricity Committee recommends the appointment of Mr. W. McD. Tait, mains engineer, Winchester, and Mr. N. Boydell, assistant mains engineer, Southport, as district engineers.

At the last annual meeting of the National Register of Electrical Installation Contractors it was announced that Mr. T. Trimnell desired to relinquish the position of solicitor and secretary of the Register on account of the calls of his legal



Mr. T. Trimnell.

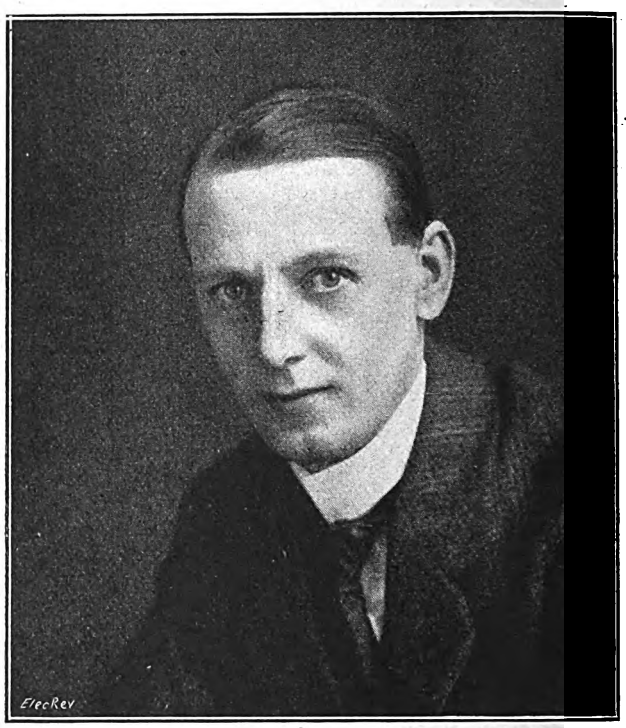
The retiring Solicitor and Secretary to the National Register.

practice. Mr. Trimnell, whose portrait accompanies this note, has now resigned and is succeeded by Mr. A. Montgomery who has had considerable experience of the electrical industry. A great deal of the success which the Register has achieved has been due to the assiduous attention which Mr. Trimnell has paid to the organisation since its inception. He will continue to act in a consultative capacity.

At a bridge drive recently organised by the South Wales and Monmouthshire Branch of the Electrical Association for Women and held at Cardiff, Mrs. J. Tyler, the retiring honorary secretary of the branch, was presented with a cheque on behalf of the members. Mrs. C. T. Allan (chairman) made the presentation. Since the inception of the branch three years ago nearly 300 members have been enrolled.

It is announced that Dr. C. V. Drysdale, O.B.E., Superintendent of the Admiralty Research Laboratory, has been appointed Director of the Scientific Research and Experiments Department of the Admiralty in succession to Dr. F. E. Smith, C.B., C.B.E., F.R.S., who is the new Secretary to the Department of Scientific and Industrial Research.

We reproduce with this note a portrait of Mr. B. A. Robinson, who delivered his address as chairman of the North-Eastern Centre of the Institution of Electrical Engineers on Monday last, October 21st. Mr. Robinson was educated at the Portsmouth Technical College, Regent Street Polytechnic, and Finsbury Technical College (under Silvanus P. Thompson), and received his early electrical training at the G.P.O., St. Martin's-le-Grand, between 1905 and 1907. From the latter year until 1910 he was assistant engineer to the Amalgamated Radio-Telegraph Co., Ltd., and was then for two years engineer to the Poulsen Radio-Telegraph Syndicate. He was thus intimately connected with early radio research, and especially the development of high-speed telegraphy, using the earliest forms of Einthoven galvanometer. In 1912 Mr. Robinson joined the Cambridge Instrument Co., Ltd., under the late Sir Horace Darwin, and since that date has been associated with that company in the technique of measurement in many fields of science and engineering. He became resident technical engineer for the company at Newcastle-on-Tyne in 1919. Mr. Robinson, in view of his long experience, is a recognised authority in the North of England upon questions of measurement. His connection with the I.E.E. began in 1910, when he became a student; he was vice-chairman of the Students'



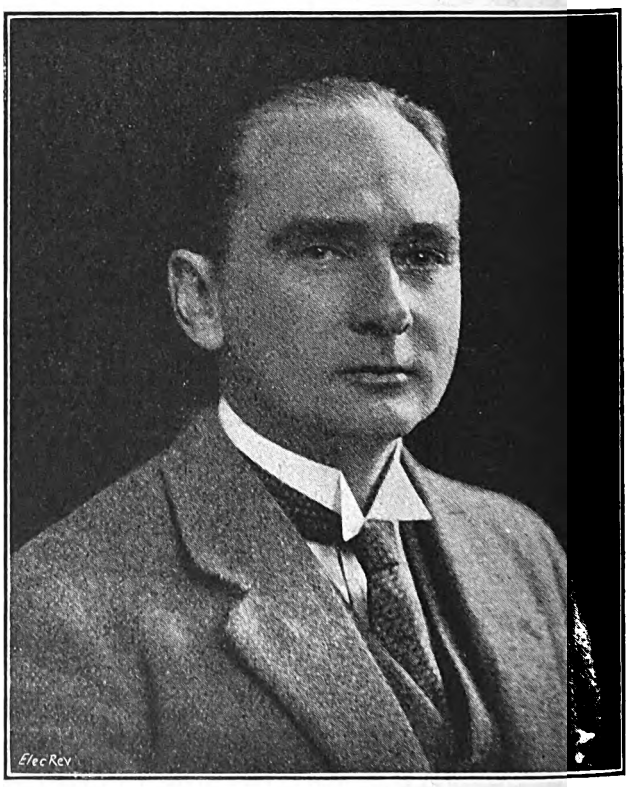
Elliott & Fry] [*London.*

Mr. B. A. Robinson, M.I.E.E., A.M.I.Mech.E.

Chairman of the North-Eastern Centre of the I.E.E.

Section in 1911, and chairman in the following year. He was elected an associate member in 1916, and member in 1923, and served as vice-chairman of the North-Eastern Centre in 1927.

We reproduce below a portrait of Mr. L. A. Baumann, who, as structural engineer to the Irish Free State Electricity



Lafayette] [*Dublin.*

Mr. L. A. Baumann.

Structural Engineer for the Shannon Scheme.

Supply Board, is in charge of the steel transmission line structures and outdoor sub-stations of the Shannon hydro-electric scheme. Mr. Baumann was born in Norway in 1887, and took his civil engineering degree at Trondhjem Polytechnical Institution in 1911. From 1911 to 1921 he was con-

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cerned with the planning and construction of hydro-electric undertakings, and until 1926, when he received his present appointment, he was engaged in the construction of transmission systems in Norway.

Fulham Borough Council Electricity and Lighting Committee recommends that the following Staff Management Committee be appointed to carry out the ordinary managerial duties of Mr. A. J. Fuller, borough electrical engineer, whilst he is acting as joint consulting engineer in connection with the extension of the generating station under the South-East England Electricity Scheme, in the first instance for a period of 12 months, and that the members of the Committee be given extra remuneration as shown:—Mr. A. Murdoch (power house engineer, chairman), £125 per annum; Mr. J. F. White (mains superintendent), £100 per annum; Mr. N. A. Chesterfield (commercial superintendent), £100 per annum); Mr. E. M. Brown (chief clerk), £75 per annum.

Mr. C. L. Faunthorpe, for over 26 years mains assistant in the Blackburn Corporation Electricity Department, is retiring. After a short period in the South, Mr. Faunthorpe proposes to travel on the Continent. He was appointed mains assistant in the Croydon Corporation Electricity Department in 1900, and in 1903 was selected for a similar position at Blackburn.

The Blackburn Corporation Electricity Committee last Saturday selected Mr. W. Arden Royle, assistant engineer and manager to the Sunderland electricity undertaking, to succeed Mr. Wheelwright as chief engineer and manager.

Obituary.—Mr. A. A. Dirks.—The *Industrial Australian* records that Mr. A. A. Dirks passed away in Sydney on September 1st. He joined the Commonwealth Postal Department as a cadet, and rose to the position of assistant electrical engineer. In 1906 he was sent to Western Australia as a special commissioner to inquire into the administration of the Engineers' branch of the G.P.O., and when its reorganisation was decided upon, he was appointed chief engineer for Western Australia. In 1911 he was appointed chief electrical engineer for Victoria, and there supervised the introduction of the automatic exchange at Geelong, the first of its kind in the Commonwealth. In 1916 he succeeded the late Mr. Nelson as chief electrical engineer of the Postal Department for New South Wales, which position he held till his retirement in 1918.

Mr. F. Callender.—The death occurred on October 19th, at Worthing, after a long illness, of Mr. Frank Callender, brother of Sir T. O. Callender (Callender's Cable & Construction Co., Ltd.), and youngest son of the late William Ormiston Callender, of Bournemouth.

Dr. F. W. O'Connell.—We regret to record that Dr. Frederick William O'Connell, D.Litt., Assistant Director of the Dublin Broadcasting Station, has died after being knocked down by a motor-omnibus.

Will.—The late Sir John M. Gatti, a past-chairman of the London County Council, and managing director of the Charing Cross Electricity Supply Co., Ltd., left unsettled property valued at £265,689 gross and £254,988 net.

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Acoustophone, Ltd.—Private company. Registered October 17th. Capital £1,000 in 500 10 per cent. cumulative participating preference and 500 ordinary shares of £1 each. Objects: To adopt an agreement with D. Douet, and to carry on the business of manufacturers, erectors, installers, mainters and repairers of and dealers in all radio-gramophones, gramophone records, radio receivers, telegraphic apparatus, etc. The subscribers (each with one preference share) are: J. A. Stokes, 4, Whitehall Court, S.W.1.; A. Goodwin, Norfolk Street, Strand, W.C.2, solicitor's manager. The directors are to be appointed by the subscribers. Registered office: 82, Pelham Street, South Kensington, S.W.7.

& Co., Ltd.—Private company. Registered October Capital £500 in £1 shares. Objects: To carry on the ess of electrical and mechanical engineers, contractors, merchants, manufacturers of and dealers in electrical, tic, telegraphic, telephonic and other appliances and tus, globes, shades, accumulators, meters, radio-tele- and telephones, &c. The directors are: J. G. Paris, ilkner Square, Liverpool, fine art dealer; W. M. Herd, ellor Road, Prenton, Birkenhead, electrical engineer. fication: £1. Registered office: D2, Exchange Buildings, ool.

orister Radio, Ltd.—Private company. Registered ber 18th. Capital £100 in £1 shares. Objects: To carry e business of manufacturers of and agents for and dealers l kinds of radio goods, and in particular as manufacturers sellers of "Chorister" radio products, &c. The first tors are: H. G. Furlong, 704, High Holborn, W.C.1, ulting engineer (chairman); W. H. Murad, 74, Lissenden sions, Highgate Road, N.W.5, engineer (managing tor). The above are life directors. Secretary: H. E. tman-Botting. Registered office: 15, Queensway, Ponder's d, Middlesex.

Flexible Wires, Ltd.—Private company. Registered October 17th. Capital, £3,000 in £1 shares. Objects:—To acquire the business carried on by L. A. Gomersall at Astor House, Aldwych, W.C.2, and to carry on the business of dealers in electrical wire, switchgear and electrical appliances of all descriptions. The first directors are:—L. A. Gomersall, Oakshade, Somers Road, Reigate, electrical engineer (managing director); M. Kirkup, 22, St. Stephen's Road, Bayswater, W.2, merchant; E. C. Magnus, 147, Grosvenor Road, Highbury, N.5, electrical salesman. Qualification:—£100. Registered office, Astor House, Aldwych, W.C.2.

Leysian Electric Lamp Co., Ltd.—Private company. Registered October 17th. Capital £100 in £1 shares. Objects: To carry on the business of electrical engineers, manufacturers of electrical accessories, electrical and radio agents, &c. The first directors are: D. Martin and A. Martin, 37, New Road, E.1. Secretary (pro tem), D. Martin. Registered office: Leysian Buildings, 114, City Road, E.C.

Guaranteed Accumulator Services, Ltd.—Private company. Registered October 18th. Capital £500 in £1 shares. Objects: To act as manufacturers, agents, and distributors of electrical accumulators, and mechanical, radio, musical apparatus and accessories, &c. The first directors are: A. B. Gates, 7, Station Road, Wealdstone, battery specialist; A. J. Scott-Dack, 17, Salisbury Road, Harrow, radio engineer; D. B. H. Robinson, 63, Barkstone Gardens. S.W.5, chemist. Registered office: 7, Station Road, Wealdstone.

Mason (Electro-Medical), Ltd.—Private company. Registered October 12th. Capital £2,000 in 1,900 shares of £1 each and 2,000 shares of 1s. each. Objects: To carry on the business of manufacturers of and dealers in electrical apparatus and appliances; to promote and encourage the study and investigation of electrical and electro-medical science, X-rays, &c. The first directors are: J. W. Mason, 53, Maybury Mansions, New Cavendish Street, W.1, ray therapy expert; Doris M. Mason, 53, Maybury Mansions, New Cavendish Street, W.1, nurse. Registered office: 96, Wigmore Street, W.1.

Graphones, Ltd.—Private Company. Registered October 14th. Capital £500 in £1 shares. Objects: To carry on the business of gramophone dealers, wireless, electrical lighting, telephone and general engineers and engineering contractors, consulting wireless experts, designers, manufacturers, factors, wholesale repairers and repairers of and dealers in radio and telephone apparatus and supplies of all kinds, &c. The subscribers (each with one share) are: L. C. Degassick, 327, Cowbridge Road, Cardiff, merchant; C. L. Thorn, 114, Malefant Street, Cardiff, accountant's clerk. The first directors are not named. Secretary (pro tem): C. L. Thorn. Registered office: 70, Cowbridge Road, Cardiff.

Hendon Lamp and Accessories Co., Ltd.—Private company. Registered October 14th. Capital, £1,000 in £1 shares. Objects:—To acquire the business of an electrical engineer and contractor and dealer in electrical accessories, appliances, and apparatus carried on by C. D. Falcke at 104, Southampton Row, W.C., as the Hendon Lamp and Accessories Co. The first directors are:—C. D. Falcke, Birchanger Cottage, Bishop's Stortford, electrical engineer; P. P. Fletcher, 12, Chester Terrace, Regent's Park, N.W.1, electrical engineer (both permanent, subject to each holding 190 ordinary shares). Registered office: 104, Southampton Row, W.C.

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Dover Coal, Gas & Power Co., Ltd.—Private company. Registered October 17th. Capital £100 in £1 shares. Objects: To carry on the business of colliery proprietors, manufacturers and suppliers of electricity, gas, &c. The subscribers (each with one share) are: G. T. Hannaford, Adelaide House, King William Street, E.C.2, chartered secretary; and F. D. Mottram, Briarbank, Hartley Down, Purley, secretary. The first directors are to be appointed by the subscribers. Qualification: One share. Secretary: C. W. Coote.

Moulding Developments, Ltd.—Private company. Registered October 14th. Capital, £1,000 in £1 shares. Objects:—To adopt an agreement with Speyer, Schwerdt & Co. (1929). Ltd., and to carry on the business of manufacturers, importers and exporters of, and dealers in insulators of all kinds, telegraphic, telephonic, electrical, mechanical, civil engineers, &c. The directors are:—E. A. L. Schwerdt (chairman), "Rosemead," Claygate, Surrey (director, Speyer, Schwerdt & Co. (1929), Ltd.); F. H. P. Watson, "Baal Bek," The Avenue, Church End, Finchley, N.3 (sales manager, Speyer, Schwerdt and Co. (1929), Ltd.). Registered office: 5 and 7, Golden Lane, E.C.1.

Radio Repairs, Ltd.—Private company. Registered October 9th. Capital, £700 in £1 shares. Objects: To carry on the business of consulting wireless experts, designers, and manufacturers of, agents for and dealers in radio, electrical and telephone appliances, &c. The permanent directors are: W. C. Adams (chairman), 5, Carshalton Grove, Sutton; W. S. Hawkins, Claremont, Carshalton Road, Sutton; K. B. Worker, 34, Montpelier Road, Sutton. Secretary: W. C. Adams. Registered office: 5, Carshalton Grove, Sutton, Surrey.

Official Returns of Electrical Companies.

Whitchurch and Pangbourne Electric Supply Co., Ltd.—Capital, £10,000 in 300 preference and 1,700 ordinary shares of £5 each. Return dated June 24th, 1929. 1,700 ordinary shares taken up. £8,500 paid. Mortgages and charges, nil.

Nathan & Allen, Ltd.—Capital, £10,000 in £1 shares. Return dated June 21st, 1929. 3,450 shares taken up. £1,100 paid. £2,350 considered as paid. Mortgages and charges, nil.

Dolywern and District Electricity Supply Co., Ltd.—Capital, £1,000 in £1 shares. Return dated May 18th, 1929. 625 shares taken up. £625 paid. Mortgages and charges, nil.

J. S. Ramsbottom & Co., Ltd.—Capital, £1,000 in £1 shares. Return dated May 15th, 1929. All shares taken up. £1,000 paid. Mortgages and charges, nil.

Midland Electric Corporation for Power Distribution, Ltd.—Capital, £1,000,000 in 200,000 preference and 800,000 ordinary shares of £1 each. Return dated April 9th, 1929. 200,000 preference and 700,000 ordinary shares taken up. £834,605 paid on 134,605 preference and 700,000 ordinary shares. £65,395 considered as paid on 65,395 preference shares. Mortgages and charges, nil.

Symondsbury Electric Lighting Co., Ltd.—Capital, £2,000 in £5 shares. Return dated April 15th, 1929. 244 shares taken up. £1,220 paid. Mortgages and charges, nil.

Melton Mowbray Electric Light Co., Ltd.—Capital, £60,000 in £5 shares. Return dated May 3rd, 1929. 9,600 shares taken up. £48,000 paid. Mortgages and charges, £19,100.

Urban Electric Supply Co., Ltd.—Capital, £800,000 in £1 shares (444,975 ordinary, 350,000 preference, and 5,025 undenominated). Return dated May 23rd, 1929 (filed June 14th). 444,975 ordinary and 350,000 preference shares taken up. £490,000 paid on 240,000 ordinary and 250,000 preference shares. £304,975 considered as paid on 204,975 ordinary and 100,000 preference shares. Mortgages and charges: £498,008 (£350,000 5½ per cent. debenture stock and £148,008 4½ per cent. mortgage debenture stock).

Direct Spanish Telegraph Co., Ltd.—Capital, £95,000 in 6,000 preference and 13,000 ordinary shares of £5 each. Return dated May 1st, 1929. 12,931 ordinary and 6,000 preference shares taken up. £94,655 paid. Mortgages and charges, £96,000 4½ per cent. debentures.

Full Light Anti-Dazzle Lamp Co., Ltd.—P. Mordant, 115/117, Cannon Street, E.C., was appointed receiver and manager on October 7th, under powers contained in second debenture dated September 28th, 1929.

Reproduction, Ltd.—Particulars filed of £7,000 debentures authorised July 16th, 1929, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being issued on September 30th, 1929.

Julians of Reading, Ltd.—Charge on certain land and premises in Reading, dated October 1st, 1929, to secure £3,650 and further advances up to a maximum of £6,000. Holder: H. Julian, "The Hermitage," Basingstoke.

Richmond (Surrey) Electric Light & Power Co., Ltd.—Capital, £200,000 in £1 shares. Return dated May 17th, 1929. All shares taken up. £200,000 paid. Mortgages and charges, nil.

Tre-Coil Works, Ltd.—J. E. Costello, C.A., 90, Cannon Street, E.C., was appointed receiver on October 2nd, under powers contained in debenture dated February 4th, 1929.

Kingsmill Art Metal & Electrical Co., Ltd.—W. H. Dunn, 57, Lodge Road, West Croydon, ceased to act as receiver or manager on September 24th, 1929.

Accumulators of Woking, Ltd. (old company).—H. T. Witt, 5, Chancery Lane, W.C.2, ceased to act as receiver and manager on October 4th, 1929.

Bowyer-Lowe Co., Ltd.—Satisfaction in full on January 26th, 1929, of charge dated November 10th, 1928, securing all moneys. (Notice filed October 10th.)

Boroughbridge & District Electric Supply Co., Ltd.—Particulars filed of £3,000 debentures, authorised by resolutions of July 16th and October 2nd, 1929, charged on the company's property, including uncalled capital, the whole amount being now issued.

Torquay Tramways Co., Ltd.—Satisfaction to the extent of £1,600 on September 11th, 1929, of charge dated March 8th, 1911, securing £60,000.

Improved Wilson Microphone & Electrical Co., Ltd.—Particulars filed of £75 debentures authorised September 16th, 1929, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Dorian Wireless Co., Ltd.—Satisfaction in full on October 1st of debenture dated August 16th, 1929, securing £2,100.

Tamplin & Makovski Ltd.—Particulars filed of £13,264 debentures authorised by resolutions of August 23rd and September 18th, 1929, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

St. Helens Cable and Rubber Co., Ltd.—Capital, £100,000 in £1 shares. Return dated August 5th, 1929. 84,000 shares taken up. £84,000 paid. Mortgages and charges, nil.

Thompson, Ritchie & Co., Ltd.—Issue on September 25th, 1929, of £800 debentures, part of a series already registered.

Merthyr Electric Traction & Lighting Co., Ltd.—Capital, £100,000 in 6,000 preference and 14,000 ordinary shares of £5 each. Return dated May 28th, 1929. 6,000 preference and 13,000 ordinary shares taken up. £95,000 paid. Mortgages and charges: £48,400.

A. Hirst & Son, Ltd.—Capital, £20,000 in 100 preference and 1,900 ordinary shares of £10 each. Return dated May 30th, 1929. 100 preference and 1,220 ordinary shares taken up. £2,200 paid on 100 preference and 120 ordinary shares. £11,000 considered as paid on 1,100 ordinary shares. Mortgages and charges, nil.

Sea Houses & District Electric Supply Co., Ltd.—Capital, £5,000 in £1 shares. Return dated May 9th, 1929. 2,910 shares taken up. £2,910 paid. Mortgages and charges: £280 1s. 11d. A return of allotments made up to May 24th, 1929, shows a further 100 ordinary shares allotted, payable in cash, and fully called up.

G. W., Ltd.—Capital, £5,000 in £1 shares. Return dated December 31st, 1928 (filed September 11th, 1929). 102 shares taken up. £102 paid. Mortgages and charges, nil.

Coley & Swinnerton, Ltd.—Capital, £2,000 in £1 shares. Return dated June 7th, 1929. 1,101 shares taken up. £1,101 paid. Mortgages and charges, nil.

Minehead Electric Supply Co., Ltd.—Capital, £50,000 in 16,000 first preference, 8,000 second preference, and 26,000 ordinary shares of £1 each. Return dated June 20th, 1929. 15,913 first preference, 7,192 second preference, and 9,865 ordinary shares taken up. £29,974 10s. paid (being £1 per share on 7,892 ordinary, 13,122 first preference, and 5,893 second preference, and 15s. per share on 2,791 first preference and 1,299 second preference shares). £1,973 considered as paid on 1,973 ordinary shares. Mortgages and charges: £20,000. A return of allotments made up to June 28th, 1929, shows a further 5,135 ordinary and 883 second preference shares allotted, payable in cash, and fully called up.

Lewes & District Electric Supply Co., Ltd.—Capital, £50,000 in 2,500 preference and 2,500 ordinary shares of £10 each. Return dated May 28th, 1929. 2,327 ordinary shares taken up. £23,270 paid. Mortgages and charges: £20,000.

West London & Provincial Electric & General Trust, Ltd.—Capital stock, £390,000 in £192,000 5 per cent. preference stock and £198,000 ordinary stock. Return dated May 10th, 1929. £192,000 preference and £198,000 ordinary stock issued. £264,000 paid. £126,000 considered as paid. Mortgages and charges, nil.

Atmos Electrical Co., Ltd.—Capital, £2,000 in 1,000 preference and 1,000 ordinary shares of £1 each. Return dated March 9th (filed August 29th), 1929. 750 ordinary shares taken up. £750 paid. Mortgages and charges, nil.

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City Notes.

Stock Exchange Notices.

The undermentioned have been ordered to be officially quoted:—

Power Corporation of Canada, Ltd.—31,826 shares of common stock of no par value.

Underground Electric Railways Co. of London, Ltd.—8,188 ordinary shares of £1 each, fully paid, Nos. 7,234,763 to 7,242,950.

Dealings in the following have been allowed by the Committee under Rule 159:—

American Telephone & Telegraph Co.—$3,155,000 capital stock in shares of $100 each.

Aron Electricity Meter, Ltd.—£103,332 income debenture stock (6 per cent. participating).

Underground Electric Railways Company of London, Ltd.—6,741 ordinary shares of £1 each, fully paid, Nos. 7,242,951 to 7,249,691.

Application has been made to the Committee to allow the following to be officially quoted:—

American Telephone & Telegraph Co.—$3,155,000 capital stock.

Crompton Parkinson, Ltd.—400,000 ordinary shares of 5s. each, fully paid, Nos. 50,001 to 450,000.

Drake & Gorham, Ltd.

The directors' report for the year ended June 30th last records a net profit of £8,220, as compared with £9,628 in the preceding year. The addition of £3,570 brought forward makes available £11,790. The dividend is maintained at 5 per cent., and £2,500 (the same) is placed to reserve, leaving £3,040 to be carried forward. Reference is made to the death, in January last, of Mr. J. M. Gorham. It is stated that in spite of the continuance of abnormal taxation and consequent trade depression, which are responsible for the somewhat reduced profits, the recent developments have resulted in a rapidly increasing turnover. The demand for the company's h.p. switchgear necessitates the acquisition of larger works, the financing of which is now under consideration. The company has received contracts for the electrical equipment of many large buildings, including the new head offices of Martin's Bank, Harrod's extensions, the Junior Carlton Club, and Bedford College. The meeting is to be held on Tuesday next.

Herbert Morris, Ltd.

The net profit for the year ended July 31st last rose from £95,022 to £95,415. To this are added interest from investments, &c., and £52,952 brought forward, making £159,017. After meeting the preference dividend, &c., it is proposed to pay a final ordinary dividend, making 15 per cent. for the year, free of tax (as for 1927-28), to place £25,000 to reserve, and to carry forward £51,605. Meeting: To-day (Friday).

Atlas Light and Power Co., Ltd.

The declaration of a final dividend of 3 per cent. on the old ordinary shares brings the year's distribution up to 5 per cent., the same rate as for 1927-28.

Erinoid, Ltd.

The directors have declared a final dividend of 4½ per cent. for the year ended August 31st last, making 7 per cent. for the year. Last year's dividend was at the same rate.

Hoffman Manufacturing Co., Ltd.

An interim dividend of 4 per cent., free of tax, has been declared on the ordinary shares, as last year.

Calcutta Electric Supply Corporation, Ltd.

The directors have declared an interim dividend of 5 per cent. for the half-year ended June 30th, on the ordinary shares.

Anglo-Portuguese Telephone Co., Ltd.

An interim dividend of 3 per cent. has been declared, as last year.

River Plate Electricity Co., Ltd.

The interim dividend on the ordinary stock is 3 per cent., as last year.

Isle of Wight Electric Light and Power Co., Ltd.

The interim ordinary dividend is again at the rate of 8 per cent. per annum, free of tax.

Shanghai Electric Construction Co., Ltd.

The interim dividend is again 5 per cent., free of tax.

French Companies.

The *Société La Radio Industrie* records net profits of 472,000 fr. for 1928-29; a dividend of 5 per cent. is paid on the preference shares.

The *Société d'Applications Industrielles* (*Compagnie d'Entreprises Electriques*) realised net profits of 7,119,000 fr. in 1928-29; the dividend is maintained at 17 per cent. on capital, increased from 30 to 40 million fr.

Stocks and Shares.

Tuesday Evening.

The outstanding feature in the Stock Exchange markets is the break that has occurred in shares of the American utility companies, many of which have recently been raised to record levels. To justify these prices it became necessary for the buyers to fall back upon the argument that Americans were no longer putting money into stocks and shares for the purpose of securing immediate income, but rather with the deliberate intention of disregarding present-day conditions, and looking to the future to provide such an increase of earning capacity as would be reflected in the price of the shares. Put more briefly, the Americans were deemed to be buying on the hope of capital appreciation, and not on the older-fashioned idea of getting good dividends right now. The difference between the British and the American angle was mentioned here in the issue of October 4th. It was then pointed out that the American investor insisted, according to Stock Exchange theorists, upon the profit-earning capacity of a company, instead of upon the current dividend distributions.

Severity of the Slump.

The former theory has been flung violently overboard in a slump during which American speculators have been unloading as quickly as possible. What brought the matter to a head it is difficult to say, because the monetary position in New York is a good deal easier than it has been for some time past. The fact remains, however, that dramatic falls have taken place. To take a few instances, Electric Bond and Share common have come down, since the third week in September, some 63 points. American Light & Power shares within the same period are more than 50 points down. General Electrics dropped 36, American Telephones 22½, Pacific Gas and Electric 32, American Gas & Electric 56. One might go on extending this lugubrious list by way of illustrating the severity of the fall, but there is little use in labouring an argument which has made its effect felt in wide directions. Shares in the companies that are familiar on this side have suffered with the rest, though not, in many cases, to the same extent. Even at the present reduced figures, the returns on the money employed in the purchase of such shares are extremely meagre, and, after the fall, several of the best-known shares still stand at prices at which the yield on the money is 3 per cent. or less.

Stock Exchange Price-Sympathy.

The slump in New York has come at a very unfortunate time for British securities, the quotations for which are already disposed to depression by reason of the many disturbing factors that prevail throughout the world. There is an over-production in so many different things at the present time; tea, for instance, rubber, oil, tin, coffee, &c. The piling-up of stocks in various commodities and metals has the effect of absorbing a good deal of money for its financing, with the result that capital is locked up at a time when it could be usefully employed in circulation. The Stock Exchange settlement in the Hatry group of stocks and shares has yet to take place, and, until this is out of the way, markets are bound to be nervous and apprehensive. Evidence is afforded that the public do not realise the close sympathy that exists between one Stock Exchange market and another.

Strength of Sound Stocks.

This sympathy is due to the fact that the man who is speculating usually has interests in a variety of markets. If his commitments become embarrassing in one direction, he has to sell, also, other things that he has open at the same time, besides stocks and shares taken up as permanent investments. Many holders of stocks and shares are exasperated at the manner in which prices fall in the securities of companies that, to all outward appearance, have no connection whatever with any of the various reasons for trouble that prevail. But experience knows only too well that a sharp fall in any particular group of stocks and shares produces an influence that is felt far beyond its immediate range. The important advances that have occurred this week in the market for British Government and gilt-edged securities are indicative of the scare which capital has had in connection with speculative risks. A generally better tone made itself felt this, Tuesday, afternoon in a number of markets.

Electricity Supply.

County of London ordinary gave way to 52s. 6d. Isle of Thanet ordinary are a florin lower, at 38s. Bournemouth and Poole were rather pressed for sale. A slight decline took Midland Counties to 33s., and Scottish Power drooped to 30s. 6d., the new shares being 6d. premium. Northamptons, at 51s. 9d., are within a few pence of the price to which they improved last week.

Dollar Stocks.

This time last week Hydro-Electrics were 71½. The price rallied to 73, and then fell, with brief spasms of resistance, to 57, recovering to 60, which left it 11½ down. International Holdings dropped to 7¾, then rose to 8½. Around Brazilian Tractions, bulls and bears fought pitched battles. The bears

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won easily, and at 67 the ordinary shares are 5½ lower; the preferred, at 225, are 15 down. Montreal Light & Power fell 3, to 167½; Pennsylvania Water 3½, to 97½; Power Corporation of Canada 6½, to 113½. The Powell River Company, of Vancouver, contemplates an expenditure of six to eight million dollars upon a first unit of an electric power plant, and on the installation of another paper-making machine. It is stated, furthermore, that the British Columbia Electric Railway intends to spread over six years the investment of fifty million dollars in British Columbia, in order to obtain increased power. This contains a hint of possible new issues in days to come.

Mexicans are flat. The Light & Power common have shed 14, dropping back to 96. Mexico Tramways are 8½ lower, at 45½. The prior-charge issues have not suffered to any noticeable extent. Pueblas are easier at 18, on the figures given here last week. Pachuca 5 per cent. bonds went back to 68½.

Atlas Light and Power.

American Telephone & Telegraph shares are 20 lower, at 290. International Telephone & Telegraph, at 120, are 15 down. Atlas Light & Power gave way to 24s. 6d. on the declaration of a final dividend of 3 per cent, making 5 per cent. for the year ended March 31st last. This is the same as the dividend for the previous year. The price recovered to 26s. 6d. on bear closing. The company's new ordinary and preference shares, offered last November, rank for dividend in the year now current. It will be remembered that the Atlas Light & Power sold part of its electric supply and traction interests to the American & Foreign Power Company, for 8½ million pounds sterling. In the British group, Automatic Telephones are unchanged at 37s. 6d., and International Automatics at 33s. 9d. Telephone Manufacturing are quoted at 3s. 3d.

Cables—and Australians.

Cables & Wireless "B" ordinary stock has been down to nearly 50; it rallied to 52½, leaving a fall of 5 points. The 7½ per cent "A" ordinary is lower, at 84, but the 5½ per cent. preference has held its previous advance to 96, in sympathy with the strength of gilt-edged stocks. Australian loans, of which some were issued partly in connection with electrical schemes, are heavy, by reason of the success of the Labour Party in last week's Elections. Prices of Australian stocks and shares are nearly all easier, on political apprehensions. Of the electric lighting and power issues, Melbourne Electric consolidated ordinary stock is 177 and the 8 per cent. preference shares of £5 each are 5⅜. Adelaide Electric 6 per cent. first preference keep at 21s. 6d. The 5 per cent. A preference (upon which the dividend is paid free of tax), and the 6½ per cent. preference shares are also about the same price, 21s. 6d. In the wireless shares, Marconi Marines further receded to 2⅜, because of the reduction in the interim dividend. Baird Televisions are 6s.

Home Railways.

The Home Railway market has succeeded in standing up fairly well to the depressing conditions opposed to it, but, in spite of this, Underground Electric income bonds are 3 points down at 105, and the price of the £1 shares has weakened to 22s. Metropolitans and Districts both hold their rises of a week ago, and the market is not bad as a whole, with noticeable demand for the prior-charge stocks, of which there is none too much supply available at the present time. The various tramway and transport issues connected with London and the provinces are so neglected that their prices show no movement at all on the week. British Electric Traction holds its high level at 1,600. Shares in motor companies have given way by reason of the impression that has got round to the effect that less business is being done at the Olympia Show than anticipation had looked for in advance.

Manufacturing Companies' Shares.

The effect of the general slump upon shares in manufacturing companies is seen more particularly in Associated Electrical Industries ordinary. On heavy selling from America, the price fell from 37s. 6d. to 30s., there being little inclination on this side to support the price. General Electrics have fallen 5s. to 2⅜, the selling in this case also coming from New York. The preference shares show steadiness, and are unaffected by the fall in the ordinary. Henley's are ¼ down at 6 7/16, but no changes have occurred in Enfields at 5, British Insulated at 4½, Callender's at 4. Siemens have gone back to 27s. 6d. The 10 per cent. preference shares at 32s. 9d. hold their price well. No alteration has occurred in Johnson & Phillips at £2. India-Rubber shares weakened to 11s. 3d., English Electrics to 7s. 6d.

While the iron and steel market is dull, no particular changes of consequence have occurred. Vickers have been a shade below their present price of 8s. 4½d. The iron and steel group as a whole is disposed to be heavy. Among rubber shares, the tendency is also dull, owing to the inability of the price of the produce to make any upward headway against the over-production that continues to be noticeable in the weekly figures.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Approx. Dividend. 1927.	1928.	Price Oct. 22 1929.	Rise or fall	Yield p.c.
	£					
Bournemouth and Poole	1	15	15	63/3	—	4 15 0
Brompton Ordinary	1	8½	8½	26/-	—	5 7 8
Charing Cross Ordinary	1	8½	8½	26/6	—	5 5 8
do. do. 4½% Pref. ...	1	4½	4½	17/-	—	5 6 0
Chelsea	1	8¼	8¼	25/-	—	5 12 0
City of London	1	10	10	92/-	—	4 7 6
do. do. 6% Pref.... ...	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	40/-	+⅛	... ...
County of London	1	7	10	52/6	−1/6	3 16 4
do. do. 6% Pref.... ...	1	6	6	22/6	—	5 6 8
Edmundson's 7% Pref.	1	7	7	24/-	—	5 16 8
Elec. Supply Corporation ...	1	11	11	52/-	—	4 4 8
Kensington Ordinary	1	8	8	26/-	—	5 7 8
Lancs. Light and Power	1	7½	7½	28/-	—	5 7 2
London Electric	1	8½	9	27/6	—	5 1 10
Metropolitan	1	9	9	46/3	—	3 17 3
do. 4½% Pref.	1	4½	4½	17/-	—	5 6 0
Midland Counties	1	6½	6½	33/-	−6d.	3 18 9
Mid. Elec. Power	1	15	8	34/6	—	4 12 9
Newcastle-on-Tyne Ordinary ...	1	6	6	26/3	—	4 11 5
do. 7% Pref.	1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	10	6	6	11	—	5 9 1
North Met. Elec. 6% Pref.	1	6	6	21/6	—	5 11 8
St. James' and Pall Mall	1	8	8	26/6	—	5 5 8
Scottish Power	1	8	8	30/6	−6d.	5 4 3
South London	1	8½	8½	26/6	—	5 5 8
Urban Ordinary	1	7	7	38/3	—	3 13 6
Westminster Ordinary	1	8½	8½	25/6	—	5 9 10
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	23/6	—	6 7 8
Yorkshire Elec.	1	8		35/6	—	4 10 0

Home Rails.

Central London Ord. Assented ...	Stock	4	4	71	—	5 12 8
Metropolitan	,	8	8½	62	—	5 13 0
do. District	,,	4	5	73	—	6 17 0
Underground Electric	£1	5	7	22/-	−6d.	6 7 3
do. do. Income ...	Bonds	6	6	105	−3	5 14 3

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	98½	—	5 1 10
do. Def.	,,	1½	1½	24⅜	—	6 4 6
Automatic Telephone	1	10	12½	37/6	—	6 13 4
Cables & Wireless 5½ Pref.	Stock	—	—	96	—	5 14 7
do. A 7½ Ord.	,,	—	—	84	−1	... ...
do. B Ord.	,,	—	—	52½	−5	... ...
Globe Tel. and T. Ord.	10	10	10	23½	−10/-	*4 5 1
do. do. Pref.	10	6	6	10⅝	—	5 9 1
Great Northern Tel.	10	20	17½	30	−½	5 16 9
Indo-European	25	10	10	47½	—	*5 5 3
Marconi-Marine	1	12½	15	2⅜	−⅛	... ...
Oriental Telephone Ord	1	12	12	2 15/16	—	... ...

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	8 1/16	—	8 19 6
do. do. 2nd Pref. ...	5	6	6	8 1/16	—	9 16 0
do. do. 5% Deb. ...	Stock	5	5	75	—	6 13 4
British Electric Traction Def. Ord.	,,	5	5	1600	—	... ...
do. do. Pref. Ord.	,,	8	8	124½	—	6 8 6
Brazil Traction	100	7	8	67	−5½	2 19 8
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	86½	—	5 15 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	10/6	—	... ...
London United Tram Deb. ...	Stock	4	4	51½	—	7 15 4
Mexico Trams, 5% Bonds	—	5	5	72½	−3	6 18 0
Mexican Light Common	100	Nil	Nil	96	−14	... ...
do. 7% Pref.	100	7	7	80½	—	8 8 8
do. 1st Bonds	—	5	5	78	—	6 12 5
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...

Manufacturing Companies.

Assoc. Elec. Ord.	1	6	—	30/-	−⅜	4 0 8
Babcock & Wilcox	1	18	15	62/6	—	*4 16 0
British Aluminium Ord.	1	10	10	47/6	−⅛	*4 4 5
British Elec. Transformer Pref. ...	1	7	7	18/-	—	... ...
British Insulated Ord.	1	15	15	4⅛	—	3 12 10
Brush Ord.	Stock	10	10	130	—	7 13 10
Callenders	1	15	15	4	—	3 15 0
do. 6½% Pref.	1	6½	6½	1⅛	—	5 4 0
Crompton Parkinson Ord.	5/-	—	80	21/3	−⅛	7 1 6
do. 8% Pref.	1	8	8	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	7 1 2
do. 5% Deb.	Stock	5	5	84½	—	5 18 4
Electric Construction	1	7½	5½	15/-	—	7 6 8
Enfield Cable Ord.	1	20	20	5	—	4 0 0
English Electric	1	Nil	Nil	7/6	−9d.	... ...
do. do. Pref.	1	8	Nil	8/9	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
do. Ord.	1	10	10	2⅜	−1/16	4 4 2
Henley...	1	25	30	6 7/16	−¼	4 13 4
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	Nil	Nil	11/3	−1/16	... ...
Johnson & Phillips	1	10	—	2	—	5 0 0
Siemens Ord.	1	7½	7½	27/6	−1/16	5 9 1
Telegraph Construction	12	10	10	23	—	5 4 2

* Dividends paid free of Income Tax.

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Our Foreign Electrical Trade.

Electrical Exports and Imports during September.

THE Board of Trade returns of our overseas electrical trade during last month are very disappointing. While the exports reached the lowest level since June, 1926, the imports were higher than ever before.

Comparing the exports with those of the previous month there was a decline of £348,215. The telegraph and telephone section was responsible for £147,095 of this and the machinery class for a further £82,868. In the section covering goods and apparatus the largest decrease was shown against unenumerated goods, while there were also considerable declines in insulated wires and cables and glow lamps. The only increase of any size occurred in the case of "other" motors and generators. When compared with September, 1928, the position appears in a more favourable light. The decline in the total amounted to only £148,038, and this was due solely to the large slump in exports of submarine telegraph and telephone cable, an item which we have frequently pointed out as subject to violent fluctuations. Apart from this the only decrease of any size was that of £11,109 in the case of traction motors. There were several large advances such as those in the case of telegraph and telephone instruments and apparatus (£38,546), "other" motors and generators (£34,653), and insulated wires and cables (£33,682).

The imports were not substantially higher than in August; there were, however, a number of large increases and decreases. The former included £26,771 in the case of batteries and accumulators, £21,746 for telegraph and telephone apparatus, and £18,986 for meters and instruments. There was a fall of some magnitude (£39,804) in machinery imports, while glow lamps also experienced a large decline. As compared with September, 1928, the rise in the total was considerable (£303,613) and general. The bulk of the advance (£146,497) was attributable to telegraph and telephone apparatus, but substantial contributions were made by unenumerated goods (£53,609), unenumerated machinery (£40,218), insulated wires and cables (£30,863) and meters and instruments (£20,371). There were only three decreases and these were comparatively unimportant.

Our figures show that while British electrical exports in the first nine months of the year rose by £366,732 or 2.7 per cent. as compared with the corresponding period of 1928, the imports increased by £1,076,980 or 23.9 per cent.

The following table shows the distribution of our September exports of electrical machinery:—

Destination.	Sept., 1928.	Sept., 1929.	Inc. or dec.
	£	£	£
European countries	120,185	92,093	− 28,092
Japan	2,655	8,072	+ 5,417
South America ...	33,011	41,252	+ 8,241
South Africa ...	22,342	36,876	+ 14,534
British India ...	74,967	80,211	+ 5,244
Australia	59,958	59,937	− 21
New Zealand ...	18,116	13,468	− 4,648
Canada	13,099	24,423	+ 11,324
Other countries ...	54,691	76,216	+ 21,525
Totals	£399,024	£432,548	+£33,524

The figures show that Empire countries took about half of the exports in each month. Although the share of European countries decreased substantially their purchases for the first nine months of this year were well above those for the corresponding period of 1928, in spite of a decrease in the total for the nine months from £4,977,736 to £4,694,347.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Sept., 1929.	Inc. or dec. as compared with Aug., 1929.	Inc. or dec. as compared with Sept., 1928.	Electrical imports for Sept., 1929.	Inc. or dec. as compared with Aug., 1929.	Inc. or dec. as compared with Sept., 1928.	Electrical re-exports for Sept., 1929.	Inc. or dec. as compared with Aug., 1929.	Inc. or dec. as compared with Sept., 1928.
Electrical goods and apparatus (unenumerated)	£215,252	− £49,651	+ £30,281	£176,441	+ £15,617	+ £53,609	£11,161	+ £959	+ £4,745
Insulated wires and cables ...	241,085	− 29,651	+ 33,682	82,130	+ 9,860	+ 30,863	1,127	+ 391	− 1,007
Glow lamps	39,380	− 27,064	− 2,801	34,685	− 19,943	+ 403	963	+ 731	− 116
Arc lamps and parts ...	1,315	+ 708	+ 813	1,073	− 417	− 1,551	89	+ 69	+ 84
Batteries and accumulators ...	86,371	− 1,030	+ 17,936	96,270	+ 26,771	+ 17,793	653	− 2,374	+ 154
Meters and instruments ...	25,521	− 8,695	+ 7,734	40,234	+ 18,986	+ 20,371	694	− 17	− 531
Carbons	1,942	+ 1,056	− 757	7,684	− 61	− 1,952	128	− 79	+ 98
Switchboards (not telegraph or telephone)	2,989	− 3,925	+ 113	139	+ 139	+ 127	—	— 15	—
Electrical Machinery—									
Electrical machinery (unenumerated)	245,431	− 90,575	+ 9,980	137,867	− 39,804	+ 40,218	9,153	+ 1,843	− 1,925
Railway and tramway motors	17,041	− 694	− 11,109	—	—	—	—	—	—
Other motors and generators...	170,076	+ 8,401	+ 34,653	—	—	—	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	71,489	− 15,438	+ 20,337	4,012	+ 1,751	− 2,765	—	— 2,040	− 384
Submarine telegraph and telephone cable	45,612	− 49,054	− 327,446	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	167,027	− 82,603	+ 38,546	202,396	+ 21,746	+ 146,497	2,819	− 2,946	− 226
Totals	£1,330,540	−£348,215	− £148,038	£782,931	+ £34,645	+£303,613	£26,787	− £3,478	+ £892
	Exports			Imports			Re-Exports		
Inc. for nine months	+£366,732			+£1,076,980			+ £12,852		

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Industrial Conditions in Germany.

A Review of the 1928-29 Period.

THE Department of Overseas Trade has recently issued the customary report on "Economic and Financial Conditions in Germany," by Mr. J. W. F. Thelwall, M.C., commercial counsellor, and Mr. C. J. Kavanagh, commercial secretary, Berlin.* The report seems to occupy more pages than usual, is more up-to-date and forms a valuable record of the situation in Germany in 1928 down to about the end of May last, or even later in a few particulars.

The report opens with the statement that the sixteen months ended with April, 1929, represented an ebb in the German economic situation, which was at first gradual. The slowing down of the pace of industrial activity is ascribed to four factors. These are the completion of the large-scale re-equipment and technical rationalisation of industries, the reversal of the American money market which attracted money instead of distributing it, the revival of the reparations question, and the interference with many of the producing industries by the long and severe winter. The effect on industry of the general and financial conditions did not make itself felt as much as might have been expected, at least in the case of production. It is true that many industries experienced a falling tendency in the production, but this is considered to be hardly more than can be accounted for by seasonal influences or labour troubles, and in most cases a revival was noticeable in the early part of 1929.

Industrial Prosperity.

Although slightly less pit coal was produced in 1928, if lignite is also taken into consideration, it is found that the total quantity raised was greater, and the consumption of solid fuel rose by 3,750,000 metric tons over the previous year. In a similar manner the consumption of electrical energy increased from 25,100,000,000 kWh in 1927 to 29,000,000,000 kWh last year. During the course of 1929 the production of pit coal has shown a large increase over that for the corresponding period of last year.

In the case of the engineering industry, the report says that 1928 was a better year than its predecessor. The value of the output is estimated at 4,000,000,000 marks as compared with 3,400,000,000 marks in the previous year. The improvement was due to the large deliveries of electric power equipment and to good export orders, and like many other branches this industry benefited considerably through deliveries on reparation account. The makers of machine tools and textile machines were able to counteract the decline in the home market by larger sales to other countries.

On the whole, the iron and steel industries may be considered to have successfully overcome a critical period, and the situation was regarded sufficiently favourable for an increase in the prices of pig iron in May, 1929. During the current year the production of iron and steel has considerably improved over the corresponding period of last year. Shipbuilding, too, has to be included among those branches which were better occupied in 1928, despite a strike extending over three months. The tonnage of ships completed was 38,000 greater than in 1927; foreign orders increased, and a number of these were for reparation account. Moreover, a remarkable degree of expansion took place in the motor vehicle industry.

Import and Export Trade.

Coming to the foreign trade of Germany last year, it is noted that the general conditions are very strongly and rapidly reflected in the foreign commerce. The moment a little weakness is manifested, in the home market, the imports begin to decline, and they dropped by £11,650,000 on the year, whereas the exports last year exhibited the remarkable increase of £70,856,000. The development this year has continued favourable, the imports in the first four months having been below the monthly average in 1928, and the exports higher per month. In connection with this situation, the fact is recalled that while the sale prices of products controlled by syndicates and cartels experienced an increase last year, those of goods not under the regulation of any such organisation decreased. During the period under review, wages continued to rise and the working hours to diminish. The annual census made by the trade unions shows that of the 3,000,000 workers taken into consideration, 62 per cent. work 48 hours, or less, per week, and 23 per cent. from 48 to 54 hours.

In this connection particular interest may be attached to the question of the interchange of trade between Germany and England, showing as it does a balance in favour of the former. According to a tabular statement of trade by countries, the value of the exports from Great Britain and Northern Ireland to Germany declined from 963,066,000 marks in 1927, to 893,165,000 marks last year, whereas German exports to Great Britain and Northern Ireland rose from 1,117,517,000 marks to 1,182,386,000 marks in the two years, respectively, showing a balance in favour of Germany of £10,722,000 in the first year, and one of £14,461,000 in the second. Most of the British exports to Germany consist of raw and semi-finished materials, whereas the German exports to Great Britain comprise a wide range of manufactures. Thus the exports of machine tools in 1928 were of the value of 10,455,000 marks, and represented a quantity of 5,374 metric tons, these comparing with 10,363,000 marks and 6,034 metric tons in 1927. In the case of electrical products, the German exports to Great Britain were valued at 29,925,000 marks (8,762 metric tons) in 1928, as compared with 28,048,000 marks (8,975 tons) in 1927.

The Electrical Manufacturing Industry.

Concerning this branch, the report states that the electro-technical industry was well occupied last year, and it was again able to obtain a considerable increase in the export trade, the value of which advanced from 441,000,000 marks in 1927 to 536,000,000 marks last year. The increase in 1928 over 1927 was 24.3 per cent. in the exports to European countries, which absorbed products of the value of 419.9 million marks, 15.1 per cent. in the case of South America (49.6 million marks) and 19.2 per cent. in that of Asia (40.3 million marks).

A particularly prominent part in the larger exports last year was occupied by central station plant, dynamos and transformers, which increased by 31 per cent. over 1927; electric lamp exports rose by 30 per cent., telephone and telegraph equipment by 27 per cent., heating and cooking appliances by 33 per cent., and electro-medical appliances by 23 per cent. Radio apparatus, cables and measuring instruments, although showing an improvement over 1927, participated in a less marked degree in the general increase. On the other hand, galvanic and dry battery exports declined by 6 per cent., and porcelain insulators by 11 per cent., while accumulators remained stationary. The appended table gives a comparison of the principal exports in the two years, an all-round improvement of some 21.5 per cent. having taken place:—

German Exports of Electro-Technical Products.

Description of product.	1927 Tons.	1927 Value in 1,000 Mks.	1928 Tons.	1928 Value in 1,000 Mks.
Lighting sets and starters for motor cars	503.4	5,710	690.4	6,942
Dynamos, electric motors, and transformers—				
(a) Up to 10 kg. ...	662.5	4,967	751.5	6,129
(b) 10 kg. to 25 kg. ...	595.5	2,591	692.4	3.316
(c) 25 kg. to 150 kg. ...	3,889.4	10,319	4,512.4	13,134
(d) 150 kg. to 500 kg. ...	3,537.1	9,130	4,345.4	12,870
(e) 500 kg. to 3,000 kg.	7,912.5	17,707	7,865.3	17,698
(f) Over 3,000 kg. ...	8,620.6	15,070	11,901.0	21,249
Armatures and commutators	1,538.7	6,650	2,618.2	9,338
Metal-filament lamps ...	1,025.7	25,893	1,296.4	33,861
Telephone apparatus ...	—	21,825	—	27,493
Radio apparatus	3,541.2	41,983	4,279.6	49,348
Electrical meters and measuring apparatus ...	2,821.0	32,986	2,923.5	37,597
Magneto ignition apparatus (excluding magnetos) & other ignition apparatus, electro-technical appliances for motor cars	1,352.5	16,874	1,874.6	20,101
Apparatus for electric lighting, power transmission, electrolysis, etc.	24,239.4	85,381	31,208.9	111,877
Galvanic elements, batteries, etc.	6,373.4	13,093	6,084.1	12,340
Cable, underground or marine	42,595.6	40,662	49,039.5	47,127

According to the report, the chief markets for the smaller dynamos, in the order of their importance, were: Sweden, Holland, Denmark, Great Britain, Switzerland, Czecho-Slovakia, and Austria, while Russia remained by far the most important market for the larger types, as well as for commutators. In the case of radio apparatus one-fourth of the total exports is stated to have been purchased by Great Britain.

Concerning the German home trade, the report merely mentions that the inland market continued to be influenced by the large amount of work put in hand for the public utility companies, and the chief firms appear to have been well employed on large steam turbine sets, but business in the medium sizes was not so well maintained. The work avail-

* Stationery Office, 3s. 6d. net.

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able in telephone cables for the Post Office diminished somewhat, but the supply companies were able to place a good deal of work for sub-station switchgear.

It is stated that the A.E.G. and Siemens and Halske have embarked on the manufacture of projection apparatus for sound films, and it is reported that a considerable number of these have already been sent to Great Britain.

Electricity Production.

During 1928 both electrical firms and producers and distributors of electricity made extensive use of the foreign capital market to satisfy their need of extension and development. Electricity supply concerns alone raised about 360 million marks of foreign money, the figure rising to 500 millions, if electric railways and electrical manufacturers are added, this aggregate excluding shares sold abroad. Various extensions were put in hand or are contemplated by the supply works owned by the Reich and Prussia and the Westphalian Electricity Company, and of these some details are given in the report.

The census of the production of electricity has now been brought up to the end of 1927. In 1925 the output was stated to be 20,300,000,000 kWh; in 1926 it increased to 21,200,000,000 kWh, and in 1927 to 25,100,000,000 kWh, while the estimate for 1928 is 29,000,000,000 kWh. The quantities in 1927 were generated by 7,414 works, of which 1,399 were public stations with an output of 12,300,000,000 kWh, and 6,015 were private plants with an output of 12,800,000,000 kWh. Pit coal formed the fuel basis of 36 per cent. of the energy produced, and lignite 34.2 per cent. The use of water power experienced a slight decrease; it amounted to 15 per cent. in 1927, as against 16 per cent. in 1926, and 14 per cent. in 1925. The share of gas also declined from 11.2 per cent. in 1926 to 10.7 per cent. in 1927.

As to the conversion of railways to electric traction, the report merely mentions that the length of track which was newly electrified in 1928 amounted to 284 km., thus bringing the total length of main lines thus operated to 1,287 km., and of town and suburban lines to 225 km. New lines of a length of 217 km. were brought into service last year.

In conclusion, the report refers briefly to the posts and telegraphs, and enumerates the developments in wireless transmission between Germany and foreign countries which took place in 1928.

The Engineering Industry.

Approaching the section of the report which deals with the metallurgical and engineering industries, Mr. Kavanagh states that the latter were considerably better provided with work than in the preceding year, and the value of the production rose from 3,400,000,000 marks in 1927 to 4,000,000,000 marks last year. The activity in electric power equipment, the modernisation and extension of plant which was undertaken in the coal-mining industry, in coke oven batteries, and in the steel works plant so as to rationalise the basic industries, provided fairly satisfactory business in the home market, although a large part of the programme was nearly completed, and there has been a gradual decline in orders since the middle of last year.

The export markets were energetically cultivated, and the measure of success is evidenced by the foreign trade statistics. In this respect it is shown that the exports of machinery increased from 458,438 metric tons in 1927 to 538,026 tons last year, while the value rose from 870,218,000 marks to 1,061,387,000 marks. The opinion is expressed that exports were undoubtedly assisted to some extent by the system of "export bounties," whereby machine builders are able to buy from the steel syndicates, at the world-market prices prevailing at the time, steel products for conversion into export machines, and do not have to pay the home prices charged for the same materials for manufactures for the inland market.

Indian Electrical Notes.

From Our Indian Correspondent.

Proposed Calcutta Tube Railway.

As has already been reported, a large electric tube railway for Calcutta is proposed, and investigations have been recently completed by Mr. C. H. Lydall on behalf of the consulting engineers, Messrs. Merz & Partners. The scheme is roughly estimated to cost about £4,000,000, and is put forward in connection with the project for electrifying the suburban lines of the East Indian Railway and the Eastern Bengal Railway. The recommendations envisage a line like the London tube railways. A passenger coming from the suburbs would travel as he does now up to Howrah or Sealdah, whence the train would proceed underground. At Howrah the rail level would be approximately 100 ft. below that of the station, and the highest portion of the tunnel would pass about 50 ft. below the bed of the River Hoogly. There would be five underground stations, and the heart of the tube system would be Dalhousie Square. Arrangements would be made to deal with 16,000 passengers every half an hour, and trains would draw up on platforms every two minutes. There would be two tracks one in each direction, but each accommodated in a separate tube, the internal diameter of the tunnel being about 14½ ft. Mr. Lydall's scheme aims at a tube thoroughly up-to-date in its equipment, with escalators and automatic ticket machines. The trains will each consist of eight coaches. Details regarding air supply and electrical energy have yet to be worked out, but as electrical energy cannot be purchased in Calcutta, the possibility of generating it in the coal field and conveying it thence will be considered. The decision as to the expert's recommendations rests with the Railway Board, and will probably take some time, but preliminary boring operations to ascertain the suitability of the subsoil are in progress. A tube railway is the only solution of the Calcutta traffic problem, and though the cost is high, the feasibility of such a scheme is unquestioned.

Hydro-Electric Development in Madras.

The latest report by the chief engineer of the Hydro-electric Development Department of Madras Presidency for the year 1928-29, which has just been issued, states that the survey of the new reservoir and dam sites, the penstock profiles, power house site and transmission lines was completed and detailed plans and estimates were prepared. The report on the Pykara project was submitted to the Railway Board, which obtained the opinion of Messrs. Merz and McLellan, whose comments were generally favourable. On their recommendations the designs and estimates were further revised and brought up-to-date. Further in consultation with Messrs. Robert White & Partners, of the South Indian Railway, the proposals for electrifying certain sections of that railway were investigated and a report recommending the electrification of the Trichinopoly-Madura, Dindigul-Ollavakot, Shoranur-Podanur, Metupalayam-Erode, and the Nilgiri railway sections, has been submitted to the Railway Board. Modifications of the Pykara river scheme were evolved so that any programme of railway electrification could be taken up in future, while at the same time the construction of the works could be commenced immediately whether the railway load could be guaranteed or not. The proposals were forwarded to the Central Government for sanction and the construction of the Pykara project will be commenced as soon as sanction is received. Pending the prolonged negotiations between the Government of India and the Railway Board it was decided to undertake the construction of the Glen Morgan project in order that a start could be made towards the electrical development of the Nilgiris and a source of power made available when the main Pykara project is sanctioned. The construction of this project was sanctioned in August, 1928, but owing to delay in the supply of machinery and plant by the firms in England and the fact that the Nilgiri Railway was closed to traffic for three months owing to landslides, the construction was held up. It is expected that the plant will be in operation shortly. The estimated cost including transmission lines, &c., is Rs. 12.38 lakhs. Among the year's activities was the further investigation into the Kolaba scheme. By abandoning the previous idea of a large dam and other costly works, and evolving a more modest scheme capable of extension, it appeared that a commercially feasible proposal might be worked out. Following on a study of the methods used by the Mysore Electrical Department in developing industrial and agricultural load, a conference with tea planters in the Nilgiris was held and the results were satisfactory. Four have promised to take power when available, and others, it is anticipated, will follow suit, the indication being that the load demand in the Nilgiris will exceed estimates. A satisfactory power agreement was concluded with the Ootacamund Municipal Council, which has agreed to accept electrical energy from Glen Morgan and substantially reduce the rates to the ultimate consumer. The Conoor Municipal Council followed suit and decided to install electricity, which was to be supplied from Ootacamund. The Conoor installation will be operated at 11,000 V. In co-operation with the Electrical Inspector of Madras Presidency, and in order to speed up electrical development, efforts are being made to interest private firms to apply for licenses to distribute electrical energy to a group of towns rather than one. Such a system is more economical and will result in quicker development and a more favourable load for hydro-electric plant when it becomes available. The possibilities of developing power at the Mettur Dam now under construction in Madras have been studied and a scheme has been drawn up with all technical details concerning the project. This is now being considered in London and Switzerland, and as soon as it is received from there, a report will

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be submitted to Government. Meanwhile, a scheme to take power from the Mysore transmission lines to Mettur and distribute the power to the towns of Erode and Salem is being studied.

Ganges Valley Hydro-Electric Scheme.

A recent communiqué of the United Provinces Government announces that good progress has been made with the Ganges Canal electrical scheme, which will supply electric power to all towns with a population of 5,000 and over in the seven north-western districts of the United Provinces of Agra and Oudh. The scheme in its present form is the development of three local projects, which were individually sanctioned in 1928 as the Sumera hydro-electric scheme, the Bhola scheme, and the Ramganga pumping scheme. The Sumera scheme had for its objective the electrification of Khurja City and the pumping by electrical power of 110 cusecs from the Kala Nadi by means of a weir and supply channel, to increase the supply in the Ganges Canal. The Bhola Falls scheme included the generation of 750 kW, with a 250-kW oil-engine reserve for the electrification of Meerut, Gaziabad, and Hapur, and the laying out of 56 miles of transmission lines. The Ramganga scheme was to provide 2,400 kW hydro power, with 500-kW oil-engine reserve, for the electrification of the Bijnor and Moradabad districts, the East Indian Railway stations, and for pumping 200 cusecs from the Ramganga for irrigation. This project included 176 miles of transmission lines. The aggregate cost of the three estimates was Rs. 91.80 lakhs for works and plant, and Rs. 14¾ lakhs for establishment and overhead charges.

The position now is that the three initial schemes, which were designed as individual projects, have been linked together into a grid transmission system to supply Bijnor, Moradabad, Sararanpur, Muzaffarnagar, Meerut Bulandshah, and Aligarh districts. The electrical scheme will generate power and transmit it to the various points of supply, deriving its revenue from bulk sales. When additional load develops, more falls will be linked into the system. The power stations at Palra and at Bhola have been completed, including the erection of machinery at site, and 56 miles of transmission lines for the original Bhola scheme have been installed. The structures for double circuit lines from Bahadurabad to Sheora have been erected for a length of 86 miles, as well as the single-circuit line from Sheora to Moradabad. For crossing the Ganges and three major rivers spans of over three-quarters of a mile each have had to be constructed on this line. A line from Haipur, on the Bhola system to Moradabad is to be in use by early autumn, which will enable Moradabad to obtain additional power from Bhola. A line from Gaujrala on the latter line through Chandpur and Bijnor to Nagina, with branches to Mandawar and Kiratpur, as also a branch from Dhampur to Nehtore, will be completed by then. The main trunk line from Roorkee to Bhola will be ready by October, and a single circuit-line is under way from Bhola *via* Hapur and Bulandshahir, through Palra power station to Aligarh and Hatras. Out of 156 miles of double-circuit line and 682 miles of single-circuit line at 37,000 volts, the structures for over 243 miles have been completed, and the whole system is expected to be ready by January next. The actual cost of the works and the plant required to complete the electric power scheme is Rs. 74½ lakhs.

Rural Electrification.

A new feature in rural electrical development in India is represented by two important companies which have been brought into existence in the United Provinces by Messrs. Martin & Co., of Calcutta. These are the Upper Jumna Valley Electric Supply Co. and the Upper Ganges Valley Electric Supply Co. The first has been formed for the supply of electricity in the districts of Meerut, Muzaffarnagar, and Sharanapur, and includes 26 towns. The other has been formed to supply in the districts of Bijnor and Moradabad to 16 towns. The authorised capital of each of these companies is Rs. 10 lakhs. They will work in conjunction with the hydro-electric schemes described in the preceding paragraph, which are being carried out by the United Provinces Government, and are rapidly nearing completion. Electricity will be available in 11 of the large towns by the end of the year. The aggregate population of the towns in the Jumna Valley schemes is 231,000, and it is estimated that the capital cost of this scheme will be Rs. 4½ lakhs. In the case of the Ganges Valley scheme, the aggregate population of the 16 towns is 307,000, and the estimated capital cost is Rs. 6 lakhs.

Hydro-Electric Power in Mysore.

The possibilities of a new hydro-electric project are being investigated in the Mysore State. The site is at Chunchankatte on the Cauvery River, about 8 miles from Yedatore in Mysore. There is an anicut (irrigation barrage) across the Cauvery at Chunchankatte, called the Ramasumudram anicut, and below it there are cataracts about 40 to 50 ft. deep. Some 3½ miles upstream is the Chamaraja anicut, from which run irrigation channels on both sides. It is proposed to draw water from the Chamaraja anicut, take it to a channel on the right bank, and pass it through turbines at a point about 17 miles downstream of Chunchankatte anicut. The irrigation head sluice of the Chamraja right bank channel consists of 11 vents, 5 ft. by 6 ft., of which only six are utilised for irrigation. It is proposed to utilise the remaining five for drawing off water for power. It is proposed to construct another new channel parallel to the Chanraja for water power supply with a capacity of 100 cusecs. Gauge readings for the past ten years indicate that, even in the worst years, it will be possible to generate 500 h.p. continuously. A storage of 170 million cubic feet is necessary, and in order to obtain it the Chamraja anicut is being raised about 10 feet. The scheme is estimated to cost about Rs. 5 lakhs, and forms part of the programme of rural electrification recently inaugurated in the State.

Railway Electrification.

It is announced that the G.I.P. Railway main line electrification scheme between Bombay and Poona has been completed, and the electrified service was to be inaugurated this month. The sub-stations and overhead equipment, as well as the locomotive power, are ready. The freight and passenger locomotives to be employed on this section are noteworthy, and indicative of important development in recent locomotive building. These locomotives have been constructed and equipped by the Metropolitan-Vickers Electrical Co. to the specification of Messrs. Merz & McLellan, with special regard to atmospheric conditions. The freight locomotives are said to be the largest and most powerful ever built in England, and are equipped with motors totalling 2,600 h.p., and weigh over 120 tons. Forty-one freight locomotives and 29 passenger locomotives are being obtained. They will operate at 5,000 volts, energy being taken from an overhead line.

Electric Ship Propulsion.

Comments on its Application to Large Passenger-carrying Liners.

By ESKIL BERG, M.Amer.I.E.E., M.Amer.Soc.N.A. and Mar.E.

(*Extracts from a paper read before the* Institute of Marine Engineers.)

RECENTLY electric propulsion has been applied to the two largest passenger ships built in the United States of America. Both ships were built by the Newport News Shipbuilding Co., and the complete electrical equipment was designed and built by the American General Electric Co. The boats operate between New York and San Francisco: the first was the s.s. *California*, which made her maiden trip from New York on January 28th, 1928, and has been in continuous and most successful operation ever since. The second ship, the s.s. *Virginia*, of the same line, made her maiden trip from New York on December 8th, 1928. The data of her performance during the second trip will be used in this paper, as during that run accurate readings were taken of all the power used; that is, readings were taken every 15 minutes of volts, amperes, power factor, and kilowatts. The power readings were also checked by integrating wattmeters, so that the power of the ship was measured correctly within one-fourth of one per cent.

For the main propulsion there are installed two steam turbine-driven generators, having a rating of 6,600 kW at 2,880 r.p.m. At full power the voltage is 4,000 volts, and three-phase current is used.

There are two motors, each directly connected to a propeller shaft, of the synchronous induction type, this type being lighter and more efficient than the induction type. They have a normal rating of 8,500 h.p. at 120 r.p.m. and each has six circuits in multiple; in other words, while the motors appear to be just one, there are in reality six independent motors. If damage should be done to one coil, all that would be necessary would be to cut the coil open with a hack saw, separate and tape the ends, and only one-sixth of the power of that one motor would be lost. Under full-power operation each motor

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is connected to one turbo-generator, making two complete units entirely separated from one another. At reduced speed, however, only one turbo-generator can be used to drive both motors, and under this condition a speed of 15½ knots can be maintained (during trials 16 knots were run).

The control apparatus consists of contactors for closing the electrical circuit between the generators and the motors. There are two main operating levers for each motor, and two small wheels on the operating board that regulate the speed (r.p.m.) of the motors. One lever has three positions—"ahead," "stop," and "astern"—the other controls the excitation of the motor and the generator and has four definite positions: "off," "1," "2," and "run." On "1" position double excitation is applied to the generator alone; in this position with the reverse lever on either "ahead" or "astern," the propelling motor is started ahead or reversed as a pure squirrel-cage induction motor. In "2" position normal excitation is applied to the motor field, leaving double excitation on the generator; in this position the motor phases in and becomes synchronous. Position "run" reduces the excitation of the generator to normal.

Table I.—Particulars of s.s. *Virginia*.

Length, overall	613 ft. 1½ in.
Beam, moulded	80 ft. 3 in.
Depth to shelter deck	52 ft.
Load draught	33 ft. 9¾ in.
Displacement, tons	32,800.
Capacity of fuel oil, tons	5,436.
Rated shaft horse-power, continuous	17,000.
Speed	18 knots.
Passenger capacity, first class	400.
Passenger capacity, tourist class	400.
Freight capacity, tons	8,500.
Refrigerating cargo capacity	100,000 cu. ft.

Speed regulation of the propellers is by varying the speed of the turbine by a small wheel on the control board, which changes the governor setting of the turbine. All the switching is done with dead circuits, as an interlock is provided by which the operating lever cannot be moved before the excitation lever is on the "off" position. The switches are, however, designed to operate under full-power condition in case anything should happen to the interlock.

The boilers on the *Virginia* are of the regular Babcock and Wilcox marine type, thirty sections wide, with tubes 10 ft. 6 in long. The heating surface per boiler is 5,461 sq. ft., or a total for eight boilers of 43,688 sq. ft. Each boiler is fitted with a Babcock & Wilcox interdeck superheater having 601 sq. ft. of surface, or a total for the eight superheaters of 4,808 sq. ft. Babcock & Wilcox feed-water regulators are fitted on the drums of all boilers. The front plate of each boiler is equipped with six Babcock & Wilcox mechanical atomiser oil burners of the "Cuyama" type. On the full-power run from Balboa to San Diego (2,829 knots) the *Virginia* averaged 18.4 knots, and only six of the eight boilers were in use, showing that her boilers could easily be cut down in size.

The condensers are bolted directly under the turbine to the turbine casing, no expansion joint being used. A spring beam under the condenser takes care of any expansion due to temperature changes. Each condenser has 11,000 sq. ft. of cooling surface, consisting of ¾-in. tubes; each has two Warren 18-in. centrifugal circulating pumps, having a capacity of 8,000 gal. per minute against a 30-ft. head. They are each driven by a 100-h.p. direct-current motor, 325 to 600 r.p.m. per minute. The condensate pump is also electrically driven; its rating is 210 gal. per min. against a 60-ft. head, driven by a 7½-h.p. motor at 1,200 r.p.m. Air ejectors are used of the Wheeler 2-stage "Radojet" type.

Auxiliary Electric Power Plant.—As all the refrigeration, cooking, baking, and heating of the staterooms are electric, the power plant is rather large, consisting of four 500-kW, 240-120-volt, 3-wire system, direct-current geared turbo-generator sets. There is one condenser for each two sets, with valves, so that either set can be operated alone on the condenser, or both at the same time. Each condenser has 2,800 sq. ft. of cooling surface, using ¾-in. tubes. One motor-driven circulating pump of 3,600 gal. per min. capacity is provided for each condenser, the motor having a rating of 30 h.p. at 675-900 r.p.m. The condensate pump is also motor driven and Wheeler 2-stage air ejectors are used.

The *Virginia* has 60,000 cu. ft. of cool air space for carrying fruit and also 40,000 cu. ft. of frozen cargo space. There are four Brunswick-Kroeschell CO_2 3-cylinder compressors, each driven by a 100-h.p., 250 to 325 r.p.m., direct-current motor. The air is circulated through the cold air system by four blowers, each of 25,000 cu. ft. capacity. The whole refrigerating system, with all its pumps, &c., is motor-driven and, when running at maximum capacity, consumes about 800 h.p.

The whole galley is electrically equipped. There are, among other things, twelve large ranges and two bake ovens, the latter having a capacity of 180 1-lb. loaves of bread. The electric galley has proven itself most economical and will be adopted on all the new ships operated by the Panama-Pacific Line.

Steam Consumption.—When operating at 275 lb. pressure at the throttle and 200 deg. superheat with a vacuum of 28.5 in., the steam consumption per shaft-horse-power-hour with 17,000 h.p. delivered to the propeller shaft, including all the losses in the generator, motors, cables, and control, is 8.1 lb.

Fuel Consumption.—On the second voyage west the ship ran at full power from New York to Havana, and the fuel consumption was 0.715 lb. of oil per s.h.p.-hour. The same results were obtained from Balboa to San Diego (a distance of 2,829 knots) and also from San Pedro to San Francisco. The figure of 0.715 includes everything on the ship and, when it is considered that all the cooking and baking are done electrically, and that a very large refrigerating plant is in operation most of the time, due to the fact that the ship carries bananas and other fruit and has a refrigerating cargo space of 100,000 cu. ft., the figure of 0.715 is indeed a very fine result. It has been maintained and even slightly improved on a subsequent trip of the *Virginia*.

Electrical Losses.—At 17,000 h.p. and 120 r.p.m. of the propellers, the generators have an efficiency of 97.5 per cent., excluding excitation, which amounts to 32 kW per generator, or less than ¼ per cent. The motors have an efficiency of 98¼ per cent., excluding excitation, which amounts to 0.68 per cent. The loss in cables, control, &c., amounts to 0.04 per cent. The total transmission loss is, therefore, excluding excitation, about 4½ per cent., and with excitation about 5¼ per cent. At reduced speed of the vessel the efficiency of the generators and motors remains practically constant, as the voltage is then reduced in about the proportion of the square root of the horse-power, so that at three-quarter speed the voltage is reduced from 4,000 to 2,600 volts. The transmission loss has only increased from 5¼ to 5¾ per cent., although the power has been reduced from 17,000 to only 7,000 h.p.

The advantages of electric drive for large liners are:—

1. Electric transmission gives a simple and practical means of speed reduction between the high-speed turbine and the low-speed propeller in almost any ratio.

2. It affords means of reversal by simple change of electrical connections, without changing the direction of rotation of the turbine, and thus eliminates the space occupied by reversing turbines and their loss is incurred while the ship operates in a forward direction.

3. Any desired reversing torque up to the full power of the turbine can be obtained without in any way affecting the efficiency of the equipment in the forward direction.

4. It allows the turbine as a rule to be built in one casing, an ideal condition for efficient design, eliminating all losses due to crossover connections and reducing the number of packings and steam seals.

5. Reversal of the propellers is obtained with a minimum amount of steam drawn from the boilers, as the full inertia of the turbo-generators is first used in the act of reversal; in fact, in most cases actual reversal is obtained without drawing any steam from the boilers, and steam is only used from the boilers to accelerate the speed in the reverse rotation. This fact releases all strains on the condenser tubes and prevents leakage; in fact, condenser troubles are practically eliminated on electric ships.

6 Makes it possible to obtain accurate data, either by instantaneous readings or by recording instruments, of the load on the propeller shaft under all conditions of sea and wind; it eliminates the use of torsion meters; the total horse-power-hours can be recorded during any given time.

7. It is possible to obtain very fine economy at three-quarter speed, as during that time only one-half of the generating unit with its auxiliaries will be used; under this condition the fuel consumption per shaft-horse-power will be practically the same as at full power, a very important consideration for the very high-speed, high-power, liners now being contemplated, as these ships can be run during off season at slower speed and still maintain maximum efficiency.

8. Allows the power generating unit, or units, to be put in any convenient place near the boilers, thus greatly simplifying the steam piping; they can also be put on any convenient height, and the condenser can be mounted directly under the turbine.

9. It has been found that the make-up water on the electric ships is less than one-quarter that on any other type of similar steamer.

10. The propelling motors can also in most instances be put near the propellers, eliminating long, expensive, shafting with its many bearing losses.

11. With the electric drive the adoption of high steam pressure and superheat is ideal. As the turbine is never reversed, it cannot have extreme temperature changes. Stage extraction for heating the feed water becomes a very simple matter and has proven itself most attractive and simple on the electric ships.

12. Electric ships can be made practically noiseless, and the absolute absence of all vibration and noise on the *Virginia* is striking and always most talked about among the passengers.

Performance.—The complete log data of the second voyage of the *Virginia* are given in the paper, the following being a summary:—

On her trip from New York to San Francisco, a distance of 5,429 knots, the time of the sea passage was 12 days, 16 hours, 25 minutes.

Total oil consumed sea passage	1,643 tons
Average speed	17.8 knots
Average slip	13.6 %
Oil per s.h.p.-hr. between pilot stations	0.7396 lb.
Oil per 24 hours	129.6 tons
Oil per 100 knots	30.3 tons

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On her return trip from San Francisco to New York the following results were obtained :—

Distance	5,441 knots
Time of sea passage	12 days, 22 hrs., 28 min.
Total oil consumed, sea passage ...	1,584 tons
Average speed	17.5 knots
Average slip	11.4 %
Oil per s.h.p. between pilot stations	0.739 lb. per s.h.p.-hr.
Oil per 24 hours	122.4 tons
Oil per 100 knots	29.10 tons

Comparison.—Just recently a large new twin-screw liner, equipped with Burmeister & Wain double-acting, 8-cylinder, 4-cycle engines, had her performance published in the *Marine Journal* (New York, February 1st, 1929, issue). The particulars of this ship, as compared with the *Virginia*, are as follow :—

	Diesel Ship.	*Virginia.*
Length	608 ft. 9 in.	613 ft. 1½ in.
Width	78 ft.	80 ft. 3 in.
Displacement ..	26,700 tons	32,800 tons
Draught	29 ft.	33 ft. 9⅞ in.
Speed	18 knots	18 knots
Horse-power	26,000 indicated	17,000 s.h.p.

At 16.18 knots the starboard engine indicated 9,045 h.p. and the port engine 9.035 h.p., or a total i.h.p. of 18,080. Fuel-oil consumption, excluding lubricating oil, 77 tons for all purposes. Mean draught of ship 25 ft. 8 in. The *Virginia* under this condition needs but 11,500 h.p. to drive and her total fuel consumption is but 96 tons. As Diesel oil at the time of writing cost in New York just twice the price of fuel oil, the 77 tons of Diesel oil become the equivalent of 154 tons of fuel oil, and compares with 96 tons for the *Virginia*, which is a much larger ship. The weight of all the machinery on the *Virginia* is less than that of the Diesel ship and the space is also less, as well as the cost. It appears, therefore, as if the Diesel-engine drive for large passenger liners may not be correct from an engineering point of view, and we know that a great many of the passengers do not admire it from the point of comfort, due to its vibration. The wonderful success, economy, and popularity of the *California* and *Virginia* have drawn the attention of the whole marine world. The Ward Line and the Grace Line have recently adopted this type of drive. The Peninsular and Oriental Steam Navigation Co. has completed the big liner *Viceroy of India** with electric drive furnished by the British Thomson-Houston Co., Ltd., England, an associate company of the General Electric Co., of America. Her performance will be even better than that of the *Virginia* on account of higher steam pressure and superheat. At 18.5 knots, *Engineering* (London) reports so little sign of movement or vibration that it is hard for a passenger below decks to believe the boat is not stationary. The popularity of all-electric liners is going to be so great that the travelling public is going to demand them, and with the adoption of high steam pressure and superheat and stage extraction for heating the feed water, the economy will be so good that Diesel ships, even if the fuel price were about the same, could not compete due to the lighter weight, less space, upkeep, and first cost of the electric drive.

A great deal of attention has lately been given to the wonderful performance of the *Bremen*, and the published data credits her with a fuel consumption of 0.685 per s.h.p. for all purposes. This compares with 0.715 on the *Virginia*.

	Bremen.	*Virginia.*
Boiler pressure	330	300
Temperature steam ...	700 deg.	621 deg.
Vacuum	28.5 in.	28 in.
Boiler efficiency	85 per cent.	80 per cent.
S.H.P.	110,000	17,000

The higher boiler efficiency of the *Bremen* is because her boilers are equipped with economisers and air preheater. Making proper allowance for the higher steam pressure, superheat, vacuum, and boiler efficiency, and the fact that more efficient turbines can be designed for 110,000 s.h.p. than for 17,000 s.h.p., the 0.715 for the *Virginia* would be reduced to 0.61, as compared with the *Bremen's* 0.685.

For the very large and fast liners which are at present being considered, the General Electric Co. (America) and also the British Thomson-Houston Co. have made up rather complete and tentative designs, but they cannot be published at this time. The overall economy is, however, so good that no one should seriously consider any other type of drive. The installation of the machinery in the engine room is simple, and all steam piping is reduced to only a fraction of that required for a geared-turbine job similar to that of the *Bremen*. There is no doubt that such an installation will prove itself successful from the start, and will open up a new era in marine propulsion for high-powered, high-speed liners.

* Elec. Rev., March 8th and 29th, 1929.

Overhead-line Construction.

Some typical examples of Aerial Electric Power Transmission and Distribution Lines and Manufacturers' Notes on their Component Parts and Associated Equipment.

(*Concluded from page 654.*)

The construction and maintenance of overhead lines demand of necessity the occasional use of the saw and pruning knife, but what havoc is not infrequently done with ornamental trees before the linesman awakens to the facts that tree, wire, and aerial cable can be used to advantage, and that if a stately tree must be trimmed the operation can be accomplished without the loss of any of its grandeur. The stigma of tree and countryside desecration must not be allowed to rest on overhead-line engineers, for many people will remember few of their other faults and refuse to admit any of their improvements and services rendered in extenuation.

The Postmaster-General has agreed to make an interesting experiment as a result of protests made by the New Forest Association against the use of a bright red insulation for overhead conductors, and a bright green covering is to be used on telephone wires in Hampshire, as an attempt to achieve some degree of harmony with the prevailing hue of that beautiful region.

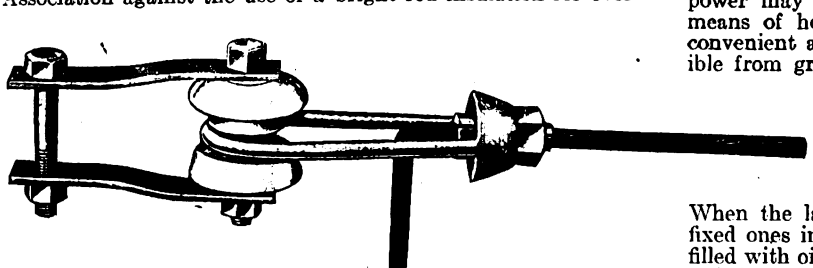

Fig. 24.—The " Buller " Line Grip.

Bullers, Ltd.

Ease of fixing is the outstanding feature of the line-gripping device illustrated in fig. 24, which is very useful when it is necessary to make-off heavy conductors for low-voltage distribution. All sizes are made for taking conductors up to 0.750 sq. in.

English Electric Co., Ltd.

A considerable factor in the problem of rural electrification is the cost of tapping off relatively small amounts of power from the e.h.p. transmission lines. Fortunately the expense of sub-station building can be obviated, since the whole of the transforming, switching, and protective gear can be designed for outdoor installation. A variety of apparatus specially suitable for this work and of economical design has been developed by the English Electric Company. Small amounts of power may be tapped off 6.6-kV or 11-kV overhead lines by means of horn-break, pole-mounted switch-fuses, which are convenient and safe, as no parts at the line voltage are accessible from ground level, the gear being operated by means of a long rod, and the fuses are swung down for replacement. Oil-immersed switch-fuses have been developed for capacities up to 100 amperes and voltages up to 33 kV. The fuses are held between spring-loaded plungers attached to contacts mounted on insulators on the hinged lid. When the latter is closed the movable contacts engage with fixed ones in the bottom of a steel tank, which is completely filled with oil. An interlocked isolating device ensures that the switch must be opened before the lid can be opened and that the lid must be closed before the switch is closed. A further attachment, especially suitable for outdoor use, is a protection cover which automatically covers the oil tank when the lid of the switch is opened. Semi-outdoor switching centres utilise these oil-immersed switch fuses, situated at the foot of a transmission line pole.

A simple outdoor sub-station suitable for use where low cost is of primary importance consists of an oil-immersed pole transformer connected to an overhead line through air-break fuses mounted on porcelain insulators; below the transformer a weather-proof sheet-steel l.p. distribution box may be also

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mounted on the transmission-line poles. Other similar examples are the 75-kVA outdoor transformer illustrated in fig. 27, and a 10-kVA transformer tapped off one phase of a 33-kV line direct through fuses mounted on a framework attached to the transformer tank.

The widely-scattered distribution area which is often characteristic of rural electrification makes the problem of maintaining the voltage at consumers' terminals within the prescribed limits somewhat acute. The company has developed small automatic feeder-voltage regulators of a weatherproof type to meet these conditions, and numerous instances have shown that it is often more economical to install an induction regulator than to try and achieve the same result by increasing the copper section of the distribution conductors. The small outdoor regulators are made in two sizes, rated at 3 and 5 kVA, respectively, on a 50-cycle circuit, and are built for either single- or three-phase distribution. They are capable of regulating the voltage by plus and minus 10 per cent. on 30- or 50-kVA distributors, or by a correspondingly smaller amount on a feeder of larger kVA. The regulator and operating gear are self-contained in a specially treated, close-grained, cast-iron tank with a weather-proof lid and inspection door. Fig. 28 shows one of these indication regulators mounted on a pole, together with a static balancer for a three-wire single-phase circuit, while a three-phase regulator may be mounted in a kiosk for semi-urban application. The operating gear that has been developed for these regulators has no contacts to deteriorate, being actuated on a simplified "Thury" principle from a small continuously-running motor requiring the minimum of attention.

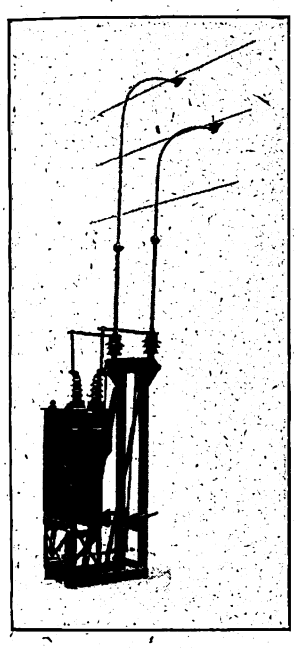

Fig. 25.—New "F.P." Live-line Tapping Device.

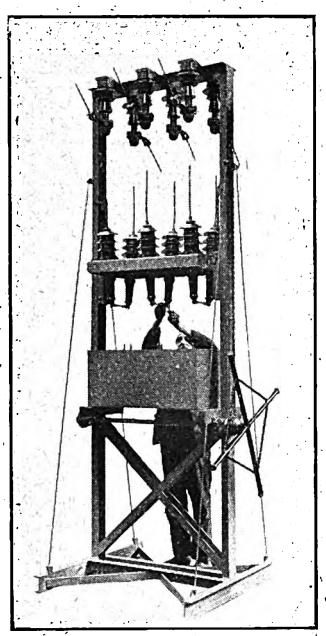

Fig. 26.—Oil-immersed Fuse Gear.

Ferguson, Pailin, Ltd.

The following descriptive notes on improved and new designs of this company's manufactures should not omit to mention that its line of air-break rocket-type switches manufactured in 11-, 22-, and 33-kV sizes up to 300 amp. capacity has been improved in the following details:—The flexible connection between the moving and fixed insulators is so constructed as to be under no mechanical stress. The control mechanism embodies a positive rod drive with "on" and "off" stops to prevent undue movement of the rocking portion. The bearings are babitted throughout, and grease caps are provided at essential points. All ironwork is now hot-dipped galvanised after all machining operations have been performed.

The single-pole oil fuses have now been applied to a wider field by the following alternative fitments:—(*a*) The 11-kV pattern is now available for the entry and exit of bare copper rod, the unit being so designed as to prevent grounding the line conductor through a bird alighting on the top of the unit. (*b*) An attachment is provided for clamping the plug element to the fuse body to ensure a watertight joint, which enables the unit to be used for underground service. When the clamping attachment is unscrewed, the fuse element may be withdrawn.

Fig. 25 illustrates a new single-phase device for tapping a live line. At present this design is available up to 33 kV line pressure for single-phase or 3-phase tappings. The equipment comprises the fabricated supporting structure, oil-immersed power transformer with expulsion withdrawable-type e.h.p. fuses, tilting line-tapping connection operated through a rod driving mechanism from near the ground. The flared contact is said to be of unique construction, having a swivel joint to permit restricted movement of the line conductors.

Fig. 26 indicates a new way of providing oil-immersed fuse protection for a single-phase or 3-phase supply tapped from an overhead line. The design embodies a double- or triple-pole oil-immersed fuse of moderate rupturing capacity, which is disconnected from the line tapping by vertical isolation in a downward direction. To inspect the fuses, the fuse unit is further lowered on to the supports, the bolts removed, and the upper portion raised, thus exposing the fuses for inspection or for replacement.

A metal-clad outdoor switch-fuse primarily designed for cable connection is at present designed in 11- and 33-kV sizes and embodies a special fuse having high rupturing capacity. The switch-fuse is of the quick-break type.

A. Reyrolle & Co., Ltd.

One very important way of effecting economy is to carefully study sub-station buildings and switchgear, with a view to reducing their cost, which has led to schemes for doing away with buildings altogether, and using switchgear that may safely be exposed to the weather. This has proved to be quite successful, especially in outlying rural districts, and this Company has developed a line of controlling apparatus embodying simple protection in the form of switch-fuses, which are metal-clad, and the circuit is broken under oil. They consist essentially of a group of oil-immersed switches in which the circuit-breaking parts are fusible cut-outs mounted on the underside of the lid of the tank containing the whole arrangement, and overload protection is also afforded in an economical way. Switch-fuses are made mostly for three-phase circuits, but are adaptable and made suitable for pressures of from 660 V to 33 kV. The self-aligning fuses are spring-mounted, and are carried on permanent porcelain supports fixed on the underside of the lid, as shown in figs. 29 and 30, so that the closing and opening of the lid makes and breaks the circuit. The lid is operated by means of a pole, and balance weights assist in swinging it back, so arranged that it comes to rest clear of the fuse tank, and may be swung with ease into such a position that it is quite safe to inspect the fuses or to work on them. Switch-fuses can be fitted with current-transformer chambers, cable dividing boxes, and the like, to meet a wide range of conditions and requirements, and metering and indicating transformers can be incorporated both in unit and in composite equipments.

Electric Control, Ltd.

It is generally somewhat difficult to examine overhead-line equipment in service closely enough to fully appreciate its features, owing to the fact that it is usually mounted on towers at a considerable distance from the ground, and because it is more often alive at high voltage and cannot be shut down. These considerations should render the exhibition of apparatus by Electric Control, Ltd., at its Westminster showrooms particularly welcome to interested engineers, as typical equipment is mounted on structures with operating mechanism and

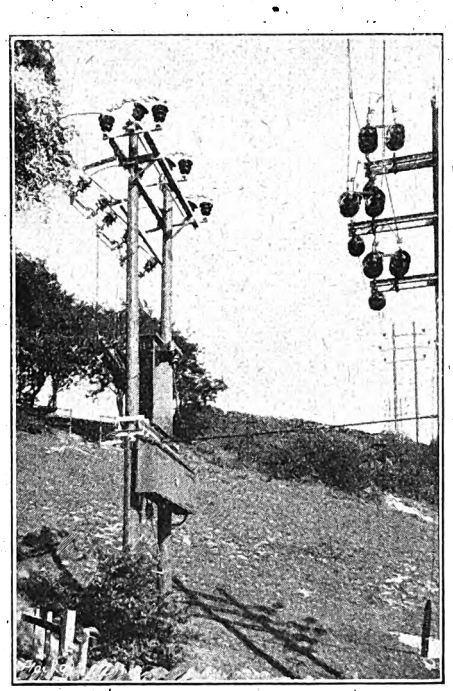

Fig. 27.—Transformers Tapped-off 33-kV Line.

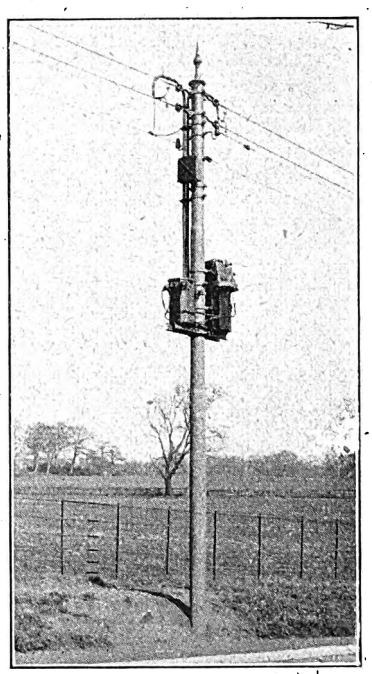

Fig. 28.—Pole-type Induction Regulator and Balancer.

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various details in a convenient form for close examination. Various forms of mounting are standardised and the under-mentioned features are possessed by all standard "Empire" equipment. The insulators used are of British manufacture and their electrical characteristics are claimed to exceed the B.E.S.A. specification for corresponding voltages. The caps and pins are jig fitted and cemented by the makers' special steam-setting process, which method of attaching the caps is declared to be superior to the use of clamp fittings. After the insulators are fitted with their caps and pins, they are rigged up in a jig and then put in a steam oven and go through a temperature cycle considerably greater than the switchgear is subjected to in service, whilst the cement is setting; the result is a high-class cemented joint which does not give trouble in service and setting them up in jigs first ensures interchangeability of the insulator. The current-carrying parts are rated to carry 200 amperes continuously and are cadmium plated throughout; thus there is no risk of electrolytic action taking place between metals of dissimilar nature when in contact. The cadmium plating also stands up very well to bad atmospheric conditions and is said to have proved very satisfactory since it was introduced some

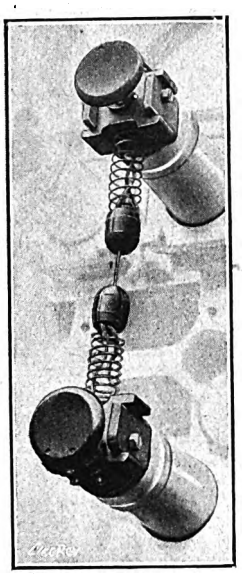

Fig. 29.—Reyrolle Switch Fuse.

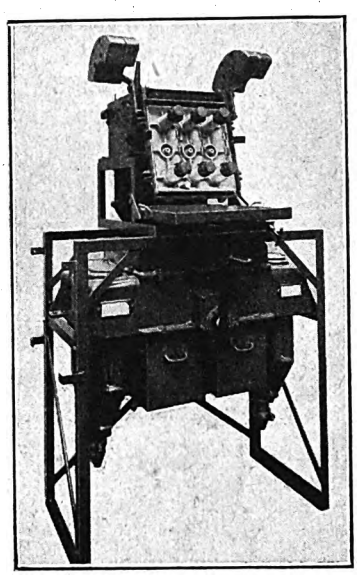

Fig. 30.—Switch-fuse, Open.

three years ago. Steel parts are all hot galvanised after the drilling and machining are finished. Solderless mechanical cone-grip line connectors are fitted, which avoid the use of sweating sockets, and the collets are drilled out to suit the size of the conductor being used, so that the joint can be easily made on site without the use of any soldering equipment. Disconnecting switches are so designed and constructed that each phase is erected separately, and provision is made for alignment adjustment to compensate for inaccuracies in the supporting framework or structure. The rocking insulators are mounted in bearings with rustless-steel pivots working in gun-metal bushes, and care is taken to avoid mechanical stresses being transmitted to the insulators when the switches are operated.

Fig. 30 shows an 11,000-volt, 200-A, outdoor t.p. vertical combined isolating fuse and switch mount; choke coils may be added when required, the fuses being of 50-ampere rating. The 66,000-volt disconnecting switch has a balanced movement and snow shields over the contacts.

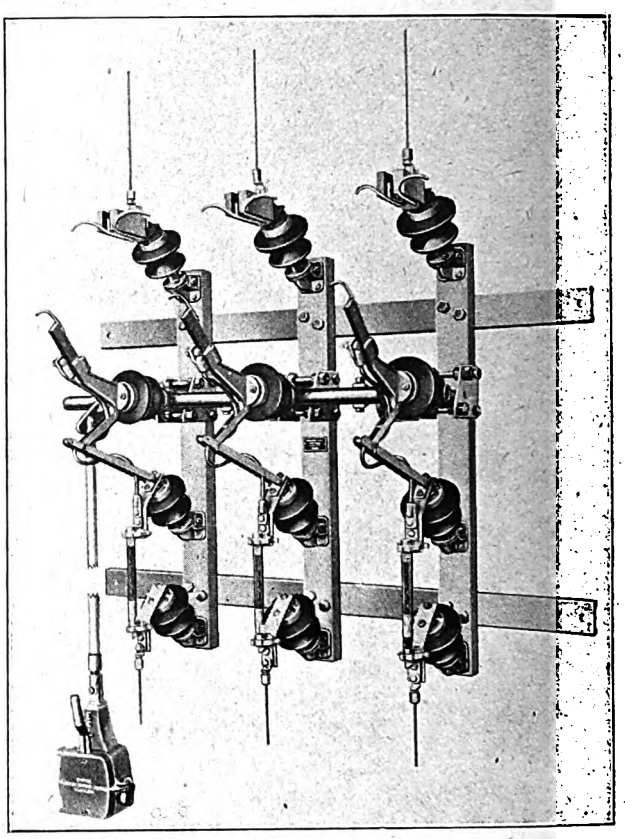

Fig. 31.—"Empire" Combined Switch and Fuse Mount.

It is understood that the company undertakes to refill "blown" fuses free of charge for a period of three years from the date of dispatch; the company has been manufacturing a complete range of high-voltage fuses for from 6,600 V up to and including 132,000 V for many years now, and 20 different fuse ratings from 1 up to 400 amperes. The high rupturing capacity and the speed of operation are claimed to make the fuses ideal for short-circuit protection and seem to be very useful, especially in connection with the e.h.p. systems, for protecting potential transformers and isolating faults in them.

Electricity Generation.

A Review of the Electricity Commissioners' Return for the Year 1928-29.

THE Electricity Commissioners' annual return of generation in Great Britain was published last week.* Unlike some government publications (such as, for example, its big brother the full statistical return of supply undertakings), this one is published with commendable promptitude whilst the figures are fresh and topical. In the present case, and in most previous years, the figures for the twelve months ending March 31st have been published by October of the same year, which must be reckoned quite good going! The figures indicate the steady all-round improvement which we have come to expect, both in output and in efficiency, though without any very outstanding development. The number of stations is at last on the decrease; actually 27 stations were permanently closed down, but owing to the putting into commission of ten new and three existing standby stations and the inclusion of eight other existing stations previously outside the scheme, the net reduction was only six.

* *Generation of Electricity in Great Britain—Year ending March 31st*, 1929. H.M. Stationery Office, 1929. Price 1s. 6d. net.

Interest naturally focusses first on the question of total output—what is its increase, and how does it compare with those of previous years. The following table gives the last four increases:—

Year ending March 31st.	1926.	1927.	1928.	1929.
Increase on previous year ...	9.5%	3.0%	18.7%	9.6%

Of these four years the two middle ones must be regarded as abnormal, since the coal dispute of 1926-7 resulted in a serious set-back which was followed by a spurt the year after. If these middle two are taken together it will be seen that there has been a steady growth of slightly under 10 per cent. per annum, and that the year under review has succeeded in maintaining this rate of growth.

As before, an enormous proportion (over 95 per cent.) of the generation was carried out in steam stations. Of the remainder, 2.2 per cent. was from waste heat, 1.4 per cent. from water, and 0.7 per cent. from oil engines. Omitting the latter, the next point to study is therefore the fuel efficiency, as expressed either in coal consumption per unit or in thermal efficiency of station. The latter method takes account of the calorific values of the fuel, but cannot very well be expressed as an average

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for the whole country. The table below summarises the position in this respect, and also the figures for the number of stations and the outputs already referred to. It will be seen that the efficiency improvement is a substantial one, but it is difficult to say, until the figures are published for plant installed, how much of this is due to better utilisation of existing machines and how much to new and better ones.

	This Year.	Change from Last Year.
Number of generating stations	564	6 less
Number of kWh generated ...	10.879×10^6	9.6% more
Fuel consumed in steam stations	9.56×10^6 tons	3.7% more
Average consumption ,, ,,	2.05 lbs. per kWh	5% less

The blue ribbon of electricity generation—for the highest thermal efficiency—has now been wrested from Barton station, though by only the narrowest of margins. In the previous year Barton achieved 21.07 per cent. This time it beat its previous record and reached 21.31 per cent., only to be outpaced by Padiham (Lancashire Electric Power Co.) at 21.35 per cent. This figure was reached in spite of a very much smaller output, and the next few years may see an exciting neck and neck race between them—until some of the newer stations come in and outdistance them both. An interesting table in the return illustrates the general effect of station size upon fuel consumption per unit. The stations are put into groups according to their outputs, and the fuel consumption is averaged for all stations in the group. The table is too long to quote in full, but the following selection (taking alternate groups) gives an idea of the results :—

Group	A	C	E	G	I	K
Output (10^6 kWh)	Over 200	50-100	10-25	2.5-5	0.5-1	0.1-0.25
Lb. of coal per kWh	1.73	2.00	2.48	3.40	7.02	11.68

It is a mistake to lay too much emphasis upon averages, and although *on the average* the larger the station the better its efficiency, it is quite possible for an individual station to stand well out above its neighbours of similar size, and even to beat the best of much larger stations. Thus Padiham (group C) has a higher thermal efficiency than any station in the larger groups A and B. Similarly Hartshead (Stalybridge Tramways) in group D beats the best station in group B, whilst Darwen Corporation (group G), Whitehaven Corporation (group H), and Colne Corporation (group K), are each of them better than the best of the previous groups. The case of Darwen is exceptional, however, because steam is also employed from a refuse destructor.

In the main body of the return each individual station is listed, together with its output, rate of consumption, thermal efficiency, maximum load and annual load factor. The load factors vary enormously, and taken by themselves are not very informative. Frequently a high load factor is due to a station being one of a group and run as a base-load station in order to utilise fully the most efficient plant. In other cases load factors of 70, 80, and even 90 per cent. are listed, due to the station being in operation only part of the time. The return differs from its predecessors in giving full particulars of these part-time stations, and in many cases the load factor is calculated on the actual number of running hours. Omitting these cases, which cannot be regarded as representative, the return shows only five "full-time" stations with load factors of over 50 per cent. The highest of these—Horden B of the Newcastle-upon-Tyne Supply Co.—claims a load factor of 86 per cent., but this is exceptional, and the other four cases are all under 55 per cent.

Referring finally to generation other than by steam, perhaps the most interesting method is that of water power which, although it represents so small a proportion of the whole, yet it shows an actual increase over the previous year of 44 per cent. Generation from oil engines also shows an 18 per cent. increase, with a 3 per cent. drop in fuel consumption per unit, but it must be remembered that this method accounts for only a negligible fraction of the total output.

The Overhead Lines Association.

A Report of the Proceedings at the Opening Meeting of the 1929-30 Session.

THE annual general meeting of the Overhead Lines Association preceded its first ordinary general meeting of the 1929-30 session in London on October 16th. Mr. W. Fennell, the retiring president, was in the chair at the former meeting.

Articles of Association.

Notice was given that it was proposed by the Council to revise the Articles of Association so as to provide for the carrying out of most of the ordinary functions of the Association by by-laws, thus following the example of the Institution of Electrical Engineers to a great extent. A sub-committee of the Council has been appointed to deal with the Articles, and will submit the revised Articles to the members as soon as possible. In this work the sub-committee will have in mind the intention of the Association to apply for incorporation as soon as funds are sufficient to meet the necessary expenditure. Apart from the simplification of the by-laws, it is proposed to extend them in certain respects. For instance, it is the desire that the Association shall have vice-presidents, and provision will be made in the revised Articles for their election. It is also proposed that provision be made for the selection of a president-elect at some time during each session, who will be elected automatically at the commencement of the following session.

Officers and Council.

The following gentlemen were elected to the offices indicated for 1929-30 :—

President: Mr. Theodore Stevens (who has previously served as hon. secretary).

Vice-presidents: Mr. W. C. Bexon and Mr. B. G. Drummond. (The Articles of Association do not yet provide for the appointment of vice-presidents, but they will automatically assume office when the revised Articles are approved.)

Hon. secretary: Major Theodore Rich.

Members of Council: Mr. R. Borlase Matthews (past president), Mr. W. P. Gauvain, Mr. A. L. Stanton, Mr. F. Christy and Mr. C. Wade (Associate Member).

Hon. auditors: Mr. Swarbrick and Mr. Napier Prentice.

The Session's Work.

Mr. W. Fennell, before relinquishing office as president, made a statement on the work of the Association during the past session. So far as the president might control the policy of an association having an active council, he had tried during this second year of the Association's work to avoid any agitation for the relaxation of regulations. The amended E.C. Regulations for Overhead Lines were issued in the spring of 1928, and it was only fair to work them for at least twelve months before dealing with them.

The Post Office, a few months ago, had given way on the second-comer claim, to which end he had devoted much of his time during the last five years. The potential value of that concession was very great, because a great injustice had been removed and expense had been obviated.

In making a plea for greater freedom for electricity supply engineers in regulations relating to overhead work, he said it had been recognised for many years that the average electricity supply engineer was as expert in underground cable work as the average assistant to the Board of Trade electrical inspector, and the inspectors left it at that and did not multiply detail. Because engineers felt full responsibility for results, they were careful and thoughtful. As a result, the art of cable, transformer, and switchgear manufacture had advanced unhindered. His aim had been that engineers should achieve that standard of freedom and full responsibility in overhead work which they had always had in underground work. With the same object in view he had endeavoured, in conjunction with the Council, to secure a set of papers which would enable the members of the Association to obtain and to demonstrate their knowledge and caution in overhead construction work. In other words, the session had been a technical and not a political one. He had also helped to initiate and to edit a monthly abstract of all papers and proceedings of the Association. The Council had been considering standardisation and wayleaves. The railway crossing difficulty had become acute, and the Association had been in close touch with the railway companies on that matter.

The membership of the Association had increased considerably during the past year; also, the Association was represented on the Overhead Lines Committee and the Overhead-line Materials Committee of the British Engineering Standards Association, and upon the British Electrical and Allied Industries Research Association Ferro-concrete Poles Committee.

Wayleave Agreements.

Mr. T. Stevens, the new president, was in the chair at the ordinary general meeting, at which attention was devoted to wayleave agreements. The Association's summary of its work on the standardising of wayleaves for rural electric lines has been published in the Electrical Review, August 16th, 1929, p. 298. The views of the Council are that a standard wayleave form with an official backing is greatly needed by electricity supply undertakings to facilitate progress. The ideal form must essentially be standard, simple, and short; it should provide both legal and practical protection to both parties; it must definitely fix every condition that it mentions; there should be no blanks (except names and the schedule) to be filled in;

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solicitors' fees should be rendered unnecessary, if the form has authoritative legal approval; and a recognised schedule of payments is of the utmost importance, for landowners and undertakers both want a definite guide as to what is fair. The Association has put forward proposed schedules for distribution and main lines.

The President, opening the discussion, said the Association had evolved the simplest wayleave form ever evolved. The only trouble was that the lawyers would not look at a simple form, but it was worth while setting an example of simplicity. The I.M.E.A. had published a form, and the only objection he had to it was that blanks were left for every one who signed it to put in different conditions; that was not a standard wayleave form. The form put forward by the Electricity Commissioners had been compiled by a solicitor. Though he appreciated highly the work of solicitors, the farmers, landowners and engineers ought to be able to make their wayleave agreements themselves, without the intervention of solicitors.

Mr. R. Borlase Matthews (past president), who urged the need for a standard wayleave form with an official backing, emphasised the well-known psychological fact that if people saw an agreement in print they were prepared to accept the conditions laid down in it as having been carefully thought out and agreed upon, and were usually prepared to sign it. Further, if the ideal form were standard, simple, and short, and capable of being understood by the man in the street, he was still more likely to sign it. Perhaps 5 or 10 per cent. of the people who were asked for wayleaves would protest when asked to sign such a form, but it was worth while producing it if the remaining 90 or 95 per cent. would sign it. It was essential also that there should be a scale of payments fair to all parties, because the ordinary man did not know what to ask for a wayleave, but, if he were shown a scale of payments which was recognised throughout the country, he would accept it as being fair. No agreement would be acceptable if it were not fair to both sides. One of the grievances among farmers was that when they were asked to give permission for transmission lines to cross their land, and when they in turn asked for a supply of electricity from those lines, it was sometimes refused, because the lines were high-voltage lines. As a result, there was a movement among the farmers' organisations to recommend farmers to say that if the electricity supply undertakings would not give them supplies they would not allow the lines to cross their lands. Undertakings whose lines crossed land under those conditions should pay more for their poles than they paid for poles carrying lines which were giving service in the district.

Mr. W. Fennell, who emphasised that wayleave agreements should be as short as possible, said he had published a standard wayleave agreement form for his own area and it had been used with great success. He had found that the printing of such a form, including the printing of the amount to be charged, had enabled him to avoid arguments, and it could almost be said that in 99 cases out of 100 the landowners (for he ignored the tenants, inasmuch as they had not the power to make such an agreement) signed the agreements. The form gave three weeks' notice, under the 1919 Electricity (Supply) Act, that it was proposed to erect a line, and the form was accompanied by a small plan (of which a carbon copy was kept). The fee was one shilling per pole, or leg, and it was made clear that the electricity supply company accepted all risks. He had a line covering a distance of five miles on one estate, and the agreement was made on the form mentioned. There had been no squabbles, and the company was careful to pay up. The payment of solicitors' fees was unthinkable, and he had not paid one. One or two landowners had tried to do the business through solicitors, but as soon as they had realised the cost involved they had carried out the business direct. As soon as an attempt was made to define risks, landowners began to conjure what the risks were and became frightened. Further, if one had a standard form and worked carefully, local opinion could be formed against a man who refused to sign until he got a higher fee, and he soon was made to realise that it was no use standing out for a fee twice as high as that accepted by his neighbours.

Mr. Matthews (U.S.A.), who was asked for information about the practice in America, said there was a body of Commissioners in practically every State to whom the property owners or power companies could appeal. Usually power companies gave the Commissioners ten days' notice that they wanted to erect a certain line, and at the same time they gave notice to the property owners concerned; if no objections were raised by the time the notice expired, the power companies carried out the work. If a property owner objected, the difficulties were settled by the Commissioners in a short time. If at any time damages were proved, arbitrators were appointed to assess them.

Miss M. M. Partridge (Electrical Association for Women) agreed that a standard form, simple and short, was essential, and urged the importance of ensuring that it should have the approval of such a body as the National Farmers' Union, which would carry weight with the landowners and farmers; it would also help if the approval of some law society could also be obtained. She hoped that the rural branches of the Electrical Association for Women would be able to help by guiding public opinion with regard to wayleaves for overhead lines.

Mr. S. C. Bartholomew (G.P.O.) pointed out that it was much more simple to proceed by notice (stating that unless objections were raised it was the intention to erect a line) than to obtain definite consent, because many people would not take the trouble to object when notice of the intention to do the work was given; neither would they take the trouble to give consent when consent was necessary.

Mr. F. Christy supported the suggestion that the Association should get into touch with the National Farmers' Union and the Landowners' Association, because those two bodies were considering very closely wayleave agreements generally. In two cases, one in Devonshire and one in Somerset, overhead lines a good many miles long were to be erected and wayleaves were being sought; about half the people concerned had signed the agreements, but about 30 per cent. had stated that, although they saw no particular objection to granting the wayleaves, the Farmers' Union was looking into the matter and they would sign nothing until the Union had made a statement.

Mr. W. Fennell also supported the suggestion that the Association should get into touch with the bodies mentioned, and added that the Landowners' Society had produced a form which was shorter than that of the Electricity Commissioners, and more reasonable in respect of most of the details.

The President said there had been correspondence with the Land Agents' Society with regard to attending a meeting of the Association, and a representative of the National Farmers' Union had already attended a meeting of the Association.

Mr. F. Swarbrick, emphasising the great desirability of adopting a simple form, said he had followed the example of Mr. Fennell. Also, he had received considerable assistance from the local branches of the Electrical Association for Women, and was quite sure that that Association would be a source of strength in dealing with the problem of wayleaves.

Mr. J. Swan said that for 25 years he had been erecting lines in Buckinghamshire, and until two years ago had used a very simple form of agreement, by which the persons concerned consented to the erection of the poles, the positions of which were indicated by a sketch; it was also stated that the supply company would make good all damage and would pay one shilling per annum. That shilling covered any number of poles on one person's ground. More recently, however, high-voltage lines were being erected, and it had been found that the very short agreement which had been so suitable hitherto was hardly suitable for the new circumstances. Consequently, a new form of agreement was prepared, but it contained very few clauses; it was an agreement with the landowner in each case that a fee of a shilling per pole and sixpence per stay be paid to the tenants of the lands on which the poles were erected, because it was felt that the tenants were the people who were affected by the erection of the poles. That agreement had been very successful.

Mr. C. F. Mounsdon, supporting the suggestion that a standard form should be evolved with the help of the Landowners' Association and the National Farmers' Union, expressed the view that it would be futile to attempt to evolve a form of agreement which had not their approval, unless there were sufficient power to enforce it against all opposition.

Mr. W. Fennell said that railway crossings were a source of great difficulty and expense. He had managed to get into touch with one or two of the railway companies, however, and had proposed on behalf of the Association that there should be one wayleave agreement as between each railway company and each electricity supply authority, for which agreement a supply authority would not mind paying a fee of, say, two guineas (because it would not be recurring); then the supply authority would pay five or ten shillings for each crossing of that railway company's lines to cover the cost of making the plans, and that a general schedule should be fixed for crossing as was fixed for crossing other people's lands.

Major Theodore Rich (hon. secretary) complained that the cost of crossing roads was often greater than it need be.

Mr. Napier Prentice regarded the payment of wayleave rentals as unnecessary, and in support of his contention pointed out that the electrification of the land was worth more to a farmer than any rental he might receive. Furthermore, he had put his contention into practice, for he had electrified eight districts in East Anglia and had not paid wayleave rentals. The agreement form was simple; in it the supply company acknowledged and expressed thanks for the wayleaves and undertook to make good any damage, and to remove the wires if required on three months notice. He had never been asked to remove wires, however, except in cases in which houses were to be built on the routes, or for some other really good reason. Considerable assistance was derived from local advisory committees, consisting of people who were interested in seeing the districts developed electrically, and who gave their services free for that object; if a landowner objected to a wayleave unreasonably the committees' influence was brought to bear upon him.

Mr. W. E. Groves (mains engineer, Birmingham) said that the I.M.E.A. form had been used at Birmingham with a certain amount of success. Referring to the giving of notices for the removal of lines from lands required for development, he suggested that development should be defined as "building," with a view to preventing the giving of notice by landowners for inadequate reasons. He did not agree with varying payments from year to year in accordance with the uses to which the lands were put, because it would be a stupendous task to watch the variation of the class of cultivation, or the state of the ground, each year. The signing of agreements should be left in the hands of wayleaves officers, in order to avoid delay.

Mr. W. Fennell pointed out that one of the grid lines in the north-western area had been erected over a row of houses, so that the erection of buildings did not necessarily involve the removal of a line. He understood, also, that the rental was similar to that paid elsewhere.

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Correspondence.

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession.

Correction of Balance by Induction Motors.

"Student" raises a very interesting point in his letter in to-day's issue. Suppose we consider the matter in the following manner:—An alternator is supplying a three-phase load, which is heavily out of balance on one phase only; the machine is delta connected, the vector for which would be something like that shown in fig. 1 below:—

a is the loaded phase. Now, if we assume that 400 V is the working pressure, and the station voltmeter is on phase *a*, it may be seen that there would be no indication of what conditions were ruling in phases *b* and *c*, which, assuming these to be unloaded, would have no internal resistance or inductance; hence a pressure of 450 V might be expected upon these two phases.

Now, if an induction motor was switched on to this circuit, two phases would be receiving an excess voltage, which would increase the inductance load of the alternator in two phases over that taken by *a*. This would tend to lower the pressures on phases *b* and *c* of the alternator, and cause excessive heating of the iron in the motor. Further, since two phases of the motor receive higher pressure than the third, these two phases would each do more work than the third; again tending to

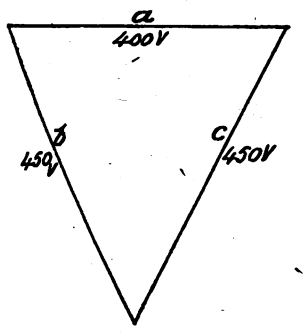

Fig. 1.

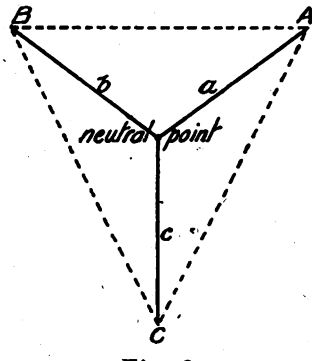

Fig. 2.

reduce the pressure in phases *b* and *c* in the alternator, and cause heating of the motor. This should now be clear, since all phases of the alternator would be equally excited, although the pressure on phase *a*, only, would be indicated. Exactly the same thing would happen when using a star connected alternator under similar conditions. I fail to see how the phase angles of an alternator can be greater or less than 120° if the coils are properly spaced, however heavily out of balance the machine may be; but I am open to correction.

One may easily test the phase angle of a supply circuit, which is invariably four-wire, by measuring the pressures from each outer to neutral, and those between each pair of outers, with a good voltmeter. Such tests should be taken as nearly as possible simultaneously. An examination of fig. 2 will make this clear, and, if matters are in order, A B=B C=C A, and $a=b=c$, and A B=$a\sqrt{3}$=B C=$b\sqrt{3}$=C A, etc. By moving the arm round, say, 5°, it will be seen that A B does not equal C A.

I trust that "Student" will now be quite *au fait* with this very interesting problem.

Delta.

October 18*th*, 1929.

Domestic Service.

Under the above heading I was pleased to see Mr. H. Willoughby-Ellis tackling vigorously a few old grievances. It is certainly necessary in all up-to-date installations to have as many outlets as possible for the use of the numerous useful domestic appliances now available. Up to a point, this is being advocated by all high-class contractors, but, as no standard has been set, the sockets are often just "stuck in" in a haphazard sort of way. The following is an extract from a supply company's specification:—"A 15-amp. switch and fuses to be used for not more than 4 sockets (heating) and 10 lighting points, the circuits to be arranged on the principle of 1 heating socket and no more than 6 lighting points per circuit." How on earth can we ever put our houses in order if supply companies are deliberately advocating this sort of thing? This also does not give us much opportunity of pointing a finger of scorn at the shoddy contractors, and is lowering the status of the whole contracting industry. The adage that shoemaker's children are the worst shod does not apply to our business, as most contractors are fully alive to the usefulness of electricity in the home. Personally, as I scribble these lines, I am sitting near my 3-kW fire, which I find is very useful and economical. Apart from this, I have found that by bringing people to my home to "see the things," further business has been the result without effort. I fully agree with Mr. Willoughby-Ellis that the shoddy contractor requires to be put under the limb of the law, and, as stated previously in these columns, I am willing to be one of the policemen, but—how are we to go about it? The problem is difficult.

A. Milne.

Glasgow, *October* 19*th*, 1929.

Electric Heating.

The trouble referred to in your last issue under the above heading is one that has been satisfactorily solved many times by the hot water and steam systems of heating where radiators have been placed under windows to correct down draughts.

In this case it seems that the trouble was only a case of not knowing that heat applied in this position is usually satisfactory for the purpose.

A. F. Caine,
A.M.I.E.E., M.I.H.V.E.

Wimborne, *October* 19*th*, 1929.

Megohms.

It is a healthy procedure occasionally to stand still to take stock of one's surroundings and to ask oneself, and possibly one's friends, if all our accepted standards and methods of procedure are necessary and desirable under existing conditions, *e.g.*, exactly how far present methods and routine are a survival of circumstances which have long since changed; for example, the desirability of employing a watchman to call the hours long after clocks were to be found in every house.

A trend of thought of this type caused the writer to ask himself whether the fetish of megohms is not a survival of direct-current working and earthed-return telegraph systems.

Take I.E.E. Regulation No. 127b, which states that the insulation resistance of an installation shall not be less in megohms than 25, divided by the number of points on the circuit (with the addition of certain provisos). On an alternating-current circuit, who would be a penny the worse if the figure obtained were 50 or even 25 per cent. of the scheduled value? Electrolysis on alternating-current supply is commonly supposed to be non-existent; telephone systems have both lines insulated and, so long as the installation is otherwise sound, and the lower value obtained on test is due to known and reasonable causes, *e.g.*, general dampness, type and extent of equipment connected, the writer would be quite prepared, if his premises are correct, to rest perfectly satisfied with the result.

An electricity supply engineer informed the writer that a short length of 2,000-volt cable had only shown 20,000 ohms to earth for the last five years and continued to function satisfactorily. Why, therefore, should he incur the cost and trouble of replacing it?

Argee.

October 18*th*, 1929.

The E.T.B.I.: An Urgent Appeal.

The Electrical Trades Benevolent Institution is sadly in need of additional capital, and I earnestly appeal to everyone connected with our great industry to assist in bringing the amount up to a minimum of £50,000. The present fund, £37,000, is wholly inadequate to meet the rapidly growing volume of claims. The number of grants made has increased six-fold during the last four years and now exceeds one per day.

Every possible effort is being made to place the fund upon a wider base of small annual subscriptions from the class which derives most benefit from the Institution, but for many years to come this source of income cannot be expected to do more than meet the immediate claims for relief of temporary distress, and the more serious necessity for pensions in cases of permanent disablement must remain unprovided for if our capital fund is not greatly increased.

There are at present on the books totally incapacitated claimants drawing small temporary relief, renewed from time to time, who could, if blessed with a small pension, retire to the country to spend their remaining days in comfort and at less expense.

Every year hundreds of good-hearted people help the Institution with their donations. To these I do most earnestly appeal to reconsider the amount of their donation in the light of their own position in the industry and remembering the vast army who when they fall upon evil days have a claim upon our benevolence. The majority of these people are earning little more than a living wage and cannot provide the necessary capital themselves.

Many employers subscribe large sums for the assistance and superannuation of their own staff—a splendid solution of much of our difficulty, but this does not help the employés of innumerable small firms and many large ones which have no such provision. At one time or another we do business with and make profit by all these people, so that although, no doubt, charity begins at home, we still have a responsibility towards others. I appeal then to those who are so generous to their own staff not to harden their hearts to the cry of the multitude without.

We are particularly wanting ten donors of £500 each to take up the ten vacant vice-presidencies of the Institution. Several gentlemen have already offered to do this, and I shall be very glad to hear from any reader of the Electrical Review who will come forward and do likewise.

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We are also wanting fifty donors of £100 to take up life governorships. There are a great many who can afford this sum, and I am most anxious to get in touch with these to explain the great assistance this help will be at the present time.

The subscription for life membership is £10. Cheques for this or any amount larger or smaller will be most gratefully received.

A recent ruling has made it clear that gifts to the Institution will be added to previous gifts to qualify the donor for a life governorship or vice-presidency.

Full details of the Institution, with particulars of receipts and distribution, will be forwarded at once upon application.

Please address donations to the Secretary, Electrical Trades Benevolent Institution, 9, Southampton Street, Holborn, W.C.2, or to the undersigned at 40, Hatton Garden, London, E.C.1.

H. Marryat,
President, E.T.B.I.

London, E.C.1, *October 16th*, 1929.

The British Industries Fair.

May I call attention to an experiment in salesmanship which, I think, may interest many of your readers? Attempts have long been made to produce a material for all sorts of toilet and fancy goods, toys, electrical instruments, motor car fittings, &c., which would take the place of celluloid. Many substitutes of varying merits must have been evolved in the last few years, but it is one thing to discover and manufacture a new material, and it is another thing to discover all the possible uses or customers for it. The manufacturers of Vitreo-Colloid tried the experiment last February of exhibiting in the British Industries Fair. There they more or less sat still while visitors from all parts of the world discovered for themselves literally dozens of different uses for the material—uses of which the manufacturers had not dreamed. Originally intended for the side screens of motor cars, the material, since the Fair, has been in demand for telephones, wireless sets, non-inflammable lamp shades for homes, offices and kinemas, hair brushes, gramophone records, railway signal lamps, traffic policemen's white sleeves, photographic and kinema films, chocolate and biscuit wrapping paper, and what not. Such rapid progress in the marketing of a new product would never have been made but for the Fair.

P. S. Newbound.

London, S.W.1, *October 15th*, 1929.

Meter Jewels.

It is curious that your correspondent should refer to an I.E.E. meeting at which meter jewels were only more or less casually mentioned, and omit to mention a more recent I.E.E. meeting devoted entirely to meter bearings. At the latter discussion statistics were given that proved beyond doubt that oil-lubricated sapphire jewels were far superior to dry ones.

A.E.G. Electric Co., Ltd.

London, *October 16th*, 1929.

A D.C. Problem.

Will any readers of this journal assist me with the following problem? Suppose we are looking at a diagram of a two-pole d.c. machine in whose armature conductors a current is flowing The conductors under each pole face form in effect one single conductor, and their fluxes apparently combine and form a band, which encircles all the conductors under each individual pole face. For the purpose of this question we will ignore whether the machine is a dynamo or a motor, its direction of rotation, or the direction of flow of the armature currents; the main fact I wish to bring to light is, that with this band of flux round the armature conductors it is apparently impossible for any of the field flux to pass through the armature teeth immediately under the poles, but the entire flux must pass in the S-shaped formation from the north to the south pole.

Inquirer.

October 14th, 1929.

Legal.

Berg v. Electrolux, Ltd., and E. D. A. Herbert.

A settlement of this action was arrived at before the Lord Chief Justice in the King's Bench Division on October 15th.

Appearing for plaintiff, Mr. Levy said the action was for alleged libel and slander. Mr. John Gustav Berg, the plaintiff, had been engaged at a substantial salary by the defendant company. Later, Mr. Herbert became managing director of the defendant company and differences arose between him and Mr. Berg which made it clear that they could not work together. Mr. Berg decided to resign as soon as Mr. Herbert had become sufficiently in possession of the details of the administration, and he did so in October, 1928. It was not long afterwards that Mr. Herbert published the alleged libellous document. The suggestion made was that Mr. Berg's dismissal followed misconduct on his part. It was now desired emphatically to refute that suggestion.

Terms of settlement included the publication of a document to the effect that Mr. Berg had been engaged by the Electrolux Co. for 3½ years and his conduct had been eminently satisfactory. As the result of a change of policy his agreement as executive manager of the company was determined and no reflection was cast on his integrity or ability. He would be paid £150 and the defendants would pay his agreed costs amounting to £520.

Counsel for the defendants assented to the settlement and the record was accordingly withdrawn on the terms stated.

Agreements Between the G.E.C. and Marconi's.

The question of the continuance of two agreements, one between Marconi's Wireless Telegraph Co., Ltd., and the General Electric Co., Ltd., and the other between these companies and the M.O. (Marconi-Osram) Valve Co., Ltd., came before Mr. Justice Eve in the Chancery Division on October 16th, on a summons taken out by the General Electric Co., Ltd., to which the other companies were respondents. Mr. Gavin Simmonds, K.C., and Mr. Peel appeared for the General Electric Co., Ltd., and Mr. Wilfred Greene, K.C., and Mr. Uthwatt for the Marconi Co. The M.O. Co. did not appear.

Mr. Simonds said the summons was for the purpose of having these agreements construed, and the question of construction was whether, as the General Electric Co., Ltd., said, the agreements were subsisting and permanent, or whether, as Marconi's said, either the agreements were for a certain definite term or they had been determined. The first agreement dated August, 1919, recited that the G.E.C. owned a factory at Brook Green which was equipped and used for the manufacture of valves. The two companies agreed to form a private company for the purpose of acquiring this business. The capital of the company was to be £100,000 subscribed for by the two companies in equal shares, and the G.E.C. was to let the factory to the valve company for ten years at a rent of £1,400 a year, and to sell the plant, &c., for £17,000. Each company agreed with the other not to manufacture valves or import valves for sale. The valve company was duly formed in October, 1919, and the second agreement contemplated by the first was entered into in November. The Marconi Co. said that the obligations of the parties under both agreements were co-terminous with the lease, but he (Mr. Simonds) contended that the term did not end with the lease.

Mr. Greene submitted that the agreement automatically came to an end on the termination of the lease. The parties could not have contemplated entering into an agreement which would last for ever.

Mr. Justice Eve reserved judgment.

Electramonic Co., Ltd.

On October 15th in the Companies Winding-up Court, Mr. Justice Romer heard a petition by Celestion, Ltd., for the compulsory liquidation of the Electramonic Co., Ltd. Mr. C. Duncan, for Celestion, Ltd., said that the Electramonic Co. was insolvent and unable to meet its obligations. His clients were creditors for £4,000; various executions had been levied but they remained unpaid. Mr. Wynn Parry, for the respondent company, said that since the petitioning company had secured control there had been an attempt to wreck the Electramonic Co. He read an affidavit by Mr. Sayers, managing director of the respondent company, in which he maintained that the petition was an attempt to break up the company so that its assets could be acquired cheaply. He alleged that the respondent company had a counterclaim against the petitioners. Counsel proceeded to state that under an agreement the respondent company was to become a selling concern for "Celestion" products. That morning the respondent company had obtained an injunction restraining Celestion, Ltd., from passing off as the respondent company's goods which were not actually of its manufacture.

Mr. Christie, who said that he represented creditors for £20,000, opposed the petition. He stated that now the control had been taken out of the hands of the petitioners or their nominees there was a chance of the company's being successful. Mr. Duncan refuted the allegations made by Mr. Sayers and asked for a compulsory winding-up order. His Lordship said that he was satisfied that the respondent company had a *prima facie* case entitling it to claim damages from the petitioners. The latter must have been aware of that when making their application and he therefore dismissed the petition with costs.

Mullard Radio Valve Co., Ltd., v. London Radio Co.

The case of the Mullard Radio Valve Co. against the London Radio Co. (Leeds) came before Mr. Justice Eve in the Chancery Division on October 18th. Counsel said it was a motion for an injunction to restrain the defendant company from infringing the plaintiffs' patent by selling valves in breach of the licence. The defendants appeared and consented to the injunction and to treat the motion as the trial of the action. They would pay ten guineas agreed damages and the costs of the action. Counsel asked that the notice of motion might be amended to read: "by selling valves below the price fixed by the licence."

Counsel for the defendants assented, and his Lordship granted an order in the terms arranged.

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Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1928.

8,887. "Electric time switching systems." J. Tammerik. March 23rd, 1928. (Convention date not granted.) (288,1444.)
9,356. "Electrical condensers." Dubilier Condenser Co. (1925), Ltd. August 4th, 1927. (295,006.)
9,742. "Electric furnaces." V. Stobie. March 31st, 1928. (319,802.)
12,409. "Devices for amplifying sounds." R. F. Tack. April 27th, 1928. (319,708.)
14,898. "Automatic train-control for railways." G. Kemmann. May 20th, 1927. (290,987.)
15,047. "Automatic current limiting and regulating devices for use in electrical signalling." G. A. Mathieu. May 22nd, 1928. (Addition to 288,371.) (319,674.)
15,556. "Counting mechanism for two-rate electricity meters." Landis and Gyr Soc. Anon. September 30th, 1927. (297,812.)
15,930. "Picture and the like facsimile telegraph transmitters." G. M. Wright. May 31st, 1928. (319,609.)
17,330. "Metallic conduits for electrical conductors." W. Shaw, G. Heptonstall and B. L. Meyer. June 15th, 1928. (319,595.)
17,759. "Variable-resistance devices." Igranic Electric Co., Ltd., and G. F. Dandridge. June 19th, 1928. (319,598.)
17,842. "Machine for twisting together wires or strands." Standard Telephones and Cables, Ltd., and W. K. Weston. June 20th, 1928. (319,632.)
17,843. "Electric signalling and indicating apparatus and the like." H. S. Cowx. June 20th, 1928. (319,600.)
17,910. "Arrangement for synchronising the selectors in long-distance control systems." Akt. Ges. Brown, Boveri et Cie. June 20th, 1927. (292,522.)
17,955. "Electric accumulators." C. J. Ward and S. E. Hilliman. June 21st, 1928. (319,634.)
18,004. "Electrically-operated closing means for vertical-chamber ovens." Bamag-Meguin Akt. Ges. June 21st, 1927. (292,539.)
18,138. "Electromagnetic relays for controlling electric circuits." Soc. Nouvelle de Constructions Téléphoniques Brevets Tchoubritch-Dervall. July 29th, 1927. (294,641.)
18,170. "Electric cleaner.' Soc. de Paris et du Rhone. September 10th, 1927. (296,978.)
18,317. "Electric protective systems and relays for use therein." A. Reyolle & Co., Ltd., H. Leben, and N. Cooke. June 25th, 1928. (Cognate application, 22,098/28.) (319,637.)
18,337. "Loud-speaker system." Brandes, Ltd. (Federal Telegraph Co.). June 25th, 1928. (319,639.)
18,420. "Electric control apparatus for use in lift installations." Medway's Safety Lift Co., Ltd., and B. A. Siden. June 25th. 1928. (319,645.)
18,442. "Electrical resisting bodies." Carborundum Co., Ltd. (Carborundum Co.). June 25th, 1928. (319,647.)
18,526. "Means for controlling light intensity in kinematograph apparatus." F. G. A. Roberts. June 26th, 1928. (319,678.)
18,537. "Electrical power distribution systems." H. Pearce and Associated Electrical Industries, Ltd. June 26th, 1928. (Cognate application, 22,413/28.) (319,813.)
18,625. "Compensation for phase variations on telegraph and telephone transmission lines." Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.). June 27th, 1928. (319,712.)
18,626. "Automatic or semi-automatic telephone systems." Standard Telephones and Cables, Ltd., J. H. E. Baker, E. P. G. Wright, and A. H. Cameron. June 27th, 1928. (319,713.)
18,649. "Sound-reproducing systems, and apparatus therefor." F. C. Tomlins. June 27th, 1928. (319,715.)
18,694. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., C. E. Beale, and R. Taylor. June 27th, 1928. (319,716.)
18,801. "Variable-capacity electric condensers." T. A. W. Robinson. June 28th, 1928. (319,819.)
18,834. "Vacuum electric tube devices." A. S. Cachemaille (Westinghouse Lamp Co.). June 28th, 1928. (319,823.)
18,872. "Trip or cam mechanism, particularly applicable to prepayment devices for use with electric meters." C. E. Fry. June 29th, 1928. (319,825.)
18,874. "Prepayment devices for use with electric meters or the like." C. E. Fry. June 29th, 1928. (319,826.)
18,875. "Release mechanism, particularly for use with electric meters, remote release switches, or the like." C. E. Fry. June 29th, 1928. (319,827.)
18,966. "Manufacture of leaded conductors." Electrical Research Products, Inc. September 10th, 1927. (296,979.)
19,032. "Electro-optical transmission systems." Electrical Research Products, Inc. July 2nd, 1927. (293,308.)
19,222. "Electric power supply apparatus." General Electric Co., Ltd., and W. Wilson. July 3rd, 1928. (319,834.)
19,249. "Performance on short circuit of rotary convertors and direct-current dynamos." English Electric Co., Ltd., and G. Schroeder. July 3rd, 1928. (319,835.)
19,281. "Electrical connectors." Siemens Bros. & Co., Ltd., and W. E. Goodwin. July 3rd, 1928. (319,837.)
19,336. "Anti-dazzle devices for the headlights or lamps of motor vehicles." A. Sinclair. March 26th, 1929. (319,842.)
19,434. "Electric time-pieces." Soc. Anon. des Etablissements, L. Hattat. July 6th, 1927. (Patent of addition not granted.) (293,423.)
19,601. "Electrically-heated apparatus for evaporating, distilling, and the like." J. A. Reavell. July 6th, 1928. (319,849.)
19,934. "Electric excess supply meters." Telefonaktiebolaget L. M. Ericsson. March 14th, 1928. (307,819.)
20,001. "Electric plug-and-socket devices." Santon, Ltd., and H. C. Sanders. July 10th, 1928. (319,851.)
20,510. "Manufacture and production of magnetic cores of high permeability." J. Y. Johnson (I. G. Farbenindustrie Akt. Ges.). July 14th, 1928. (319,854.)
20,816. "Junction boxes for electric cables." C. P. Seckham. July 18th, 1928. (319,858.)
20,936. "Electrical switches. Burovox, Ltd., S. C. Smith-Winfield, and W. P. Fraser. July 19th, 1928. (Cognate application, 31,526/28.) (319,861.)
21,273. "Circuits of ignition and lighting generators." International General Electric Co., Inc. July 21st, 1927. (294,481.)
22,147. "Loud-speakers." F. Charles. July 31st, 1928. (319,874.)
22,199. "Electrically-heated vessels provided with covers." R. Frister Akt. Ges. May 2nd, 1928. (316,867.)
22,414. "Electric potential regulators." L. H. A. Carr and Associated Electrical Industries, Ltd. August 2nd, 1928. (319,877.)
23,643. "Sound-reproducing devices." A. F. R. Cotten. August 16th, 1928. (Cognate application, 4,993/29.) (319,883.)
25,727. "Armoured cables." Siemens-Schuckertwerke Akt. Ges. and E. Willie. August 17th, 1928. (319,884.)
24,633. "Electric discharge devices." Siemens and Halske Akt. Ges. August 27th, 1927. (296,314.)
24,333. "Construction of high-tension electric cables." E. S. Ali-Cohen. September 8th, 1927. (296,784.)
26,413. "Permanent magnets." M-L Magneto Syndicate, Ltd., and E. A. Watson. September 14th, 1928. (319,915.)
27,127. "Electric switches." F. C. Fahy, W. H. Wilkinson, and J. W. Parkinson. September 21st, 1928. (319,922.)
27,436. "Electrical heaters.' T. L. Rimmer. September 24th, 1928. (319,929.)
28,598. "Thermal cut-outs for electrically-heated receptacles." Burnley Components, Ltd., and D. K. Ward. October 5th, 1928. (319,938.)
28,661. "Mercury-vapour lamp." S. Von Bogandy and L. Wamoscher. October 15th, 1927. (298,896.)
29,197. "Loud-speaker telephone instruments." J. I. Bernard. October 10th, 1928. (319,942.)
29,442. "Sound-reproducing and recording device." H. Hallam and J. R. M. Helary. October 14th, 1927. (Addition to 285,454.) (298,643.)
33,064. "Methods of protection of electric conductors." International General Electric Co., Inc. November 11th, 1927. (300,510.)
33,534. "Systems of distributing electrical signals." A. Warwick, J. A. A. Taylor, and H. C. Holmes. November 16th, 1928. (319,984.)
34,234. "Electric signs." Longsign Corporation. November 21st, 1927. (300,971.)
36,057. "Electric starting apparatus for motor-vehicle or other engines." Ateliers Vaucanson and P. Marchal. December 8th, 1927. (301,918.)

1929.

888. "Electric variable condensers." S. Moss. January 10th, 1929. (320,001.)
1,950. "Alternating-current rectifiers." Koch & Sterzel Akt. Ges. January 21st, 1928. (304,600.)
2,764. "Machine drives by means of electric motor and back-pressure turbine." International General Electric Co., Inc. January 28th, 1928. (305,029.)
9,699. "Electric gramophone pick-ups." P. D. Tyers. June 26th, 1928. (Divided application on 16,493/28.) (319,717.)
19,707. "Telephone systems." Associated Telephone and Telegraph Co. October 19th, 1927. (Divided application on 299,007.) (314,403.)
20,419. "Manufacture and production of magnetic cores of high permeability." J. Y. Johnson (I. G. Farbenindustrie Akt. Ges.). July 14th, 1928. (Divided application on 20,510/28.) (320,016.)

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from October 16th :—

Slovim. No. 505,145. Class 6. Electric vacuum cleaning machines.—C.C.A. (Vacuum Cleaners), Ltd., 324, Gray's Inn Road, W.1.

Le Miroir de la Voix (lettering and design). No. 501,543. Class 8. Radio-telephonic apparatus and parts thereof, sound amplifying apparatus, &c.—La Compagnie Générale des Machines Parlantes Pathé Frères, Paris. (British representatives: Fell & James, 11, Queen Victoria Street, E.C.2.)

Heart. No. 504,200. Class 8. Thermionic valves, battery eliminators, accumulators, transformers, and condensers, &c., all used in connection with radio-telephony.—Adolf Knopf, trading as the Wholesale Guarantee Incandescent Supply Stores, 25, Waterloo Road, S.E.1.

Twin Cone (lettering and design)). No. 504,679. All goods in Class 8.—Arthur Green, Wilga, Warwick Road, Coventry.

Cable Drum and Flex Reel (designs only). Nos. 504,737 and 504,739. Class 8. Electric cables and flexibles.—C. J. Vogel Draht und Kabelwerke Gesellschaft, Berlin. (British representatives: Boult, Wade & Tennant, 112, Hatton Garden, E.C.1.)

Trojan. No. 505,760. Class 8. Radio-telephonic apparatus, and parts thereof, &c.—British Homophone Co., Ltd., 67-69, City Road, E.C.1.

Ostar. No. 495,023. Class 13. Incandescent electric lamps (ordinary), electric switches, and switch holders.—Percy Thomas, 37, New Road, E.1.

Rees-Stevens Traction System, Rees Roturbo Mfg. Co.; Ltd., Wolverhampton (lettering and design). No. 502,981. Class 22. Motor-driven trolley omnibuses.—Rees Roturbo Manufacturing Co., Ltd.

H.M., Ltd., British (lettering and design). No. 495,374. Class 50. Ammeter and voltmeter cases, battery cases, panels and like fittings for radio-receiving sets, switch covers and moulded parts of electrical control gear, &c., made from moulding powders composed chiefly of synthetic resin.—Healey Mouldings, Ltd., 239 and 241, Great King Street, Birmingham.

Bagasite, No. 502,021, and Megasite, No. 505,448. Class 50. Compositions made from vegetable fibre, and pulps and articles made from such compositions, viz., electric insulators, electric junction boxes, lamps and lampholders, reflectors and similar fittings for electric lighting, panels, bases and cases for electrical and radio instruments, &c.—Merchant Trading Co., Ltd., 52, Bishopsgate, E.C.2.

Design only. No. 504,193. Class 50. Electrical insulating preparations.—Berry, Wiggins & Co., Ltd., Water Lane, Stratford, E.15.

Lithene. No. 503,760. Class 50. Plastic compositions made wholly or principally from cellulose acetate and from other cellulose derivatives, and goods manufactured from such compositions, including cases and panels for loud-speakers, electrical switch covers and pushes, transformer covers, &c.—Plastic Moulding Co., Ltd., 104, Albion Road, Stoke Newington, N.16.

The Severn Barrage Scheme.

Mr. D. J. Vaughan, M.P., speaking at Newnham, is reported by *The Times* to have said that the Severn barrage proposal was a commercial proposition. It would require national funds, and the cost would be from £20,000,000 to £25,000,000. The report on the proposal would not be available for another year, and when issued would have to survive criticism, if not opposition, from experts and interested bodies of all kinds. The barrage would be in the neighbourhood of the Severn railway tunnel, where there were magnificent rock foundations. Part of the barrage could, if necessary, carry both the road and the railway bridge over the Severn. In any case the road and the railway bridge ought to be near the barrage. The turbines at the barrage would provide electric energy at a fraction of a penny a unit, and would revolutionise industry even as far as the Midlands. The production and distribution of electrical energy would displace coal to some extent, but there would be compensating factors. Cheap power should lead to industrial expansion, which would provide more employment. The immense sheet of water enclosed by the barrage would attract industries to what would be one of the largest harbours in the world. The barrage would mean to the south-west what the Manchester ship canal had meant to the north. He urged local authorities to push forward both the barrage scheme and that for a road bridge. The Government Departments would appreciate the national character of both proposals if sufficient pressure were brought to bear.

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ALTON.—Rebuilding Treloar Cripples' Hospital; secretary.

AYRSHIRE.—Laboratories and buildings at Auchincruive, for Hannah Dairy Research Institute; chief surveyor, Department of Agriculture for Scotland, York Buildings, Queen Street, Edinburgh.

BANSTEAD (Surrey).—Houses (86), Roundwood Way, for Perry's (Ealing), Ltd.

BARNSLEY.—Town Hall extension (£40,000). Nurses' home, Kendray Hospital (£12,500); borough engineer. R.C. school (300 places), at Ardsley; trustees. Extensions, saw mills, Twibell Street; Co-operative Society, Ltd. Additions, Racecommon Road; Eagle Manufacturing Co.

BERKHAMSTED (Herts.).—Hospital, Ashlyns Hall estate, for the Foundling Hospital, London; secretary, 40, Brunswick Square, London, W.C.

BINGLEY.—Extensions, Grammar School (£14,400); West Riding county architect, Wakefield.

BIRMINGHAM.—Schools, Severne Road, Hall Green (£20,000); and Trescott Road, Northfield; Education Committee.

BOURNEMOUTH.—Houses (43), Charminster site. Promenade extension (£85,000); borough engineer.

BRADFORD.—Training centres at various schools, for the E.C.

BREDBURY AND ROMILEY.—Housing scheme (60), for the U.D.C.; surveyor.

BRIDLINGTON.—R.C. schools; Rev. Father O'Rourke, parish priest.

BRIERLEY HILL.—Additional 122 houses, for the U.D.C.; J. Yorke, surveyor.

CALDY (Birkenhead).—Electric lighting installation, Parish Church; vicar.

CHESTERFIELD.—Extensions, Chesterfield and North Derbyshire Royal Hospital; governors.

CLACTON-ON-SEA.—Senior school; director of education, County Education Offices, Chelmsford.

CLYDEBANK.—Baths (£30,000), for the Corporation; burgh surveyor.

COLEFORD.—Housing scheme (50), for the U.D.C.; surveyor.

COULSDON.—Houses (56), Whyteleafe estate; O'Sullivan, Ltd.

DEVIZES.—Catholic schools; Geoffrey Raymond, architect, Basingstoke; F. Rendall & Sons, builders.

EDINBURGH.—School (£25,000), for the Education Authority; master of works, Education Authority.

GLASGOW.—Houses (90), Carntyne estate; tenements and shops, Gallowgate area; housing director. Elementary schools, Calder Avenue, Knightswood, and Germiston, for the E.C.

GODALMING.—Bazaar premises, High Street, for F. W. Woolworth & Co., Ltd., Kingsway, London.

GOOLE.—Housing scheme (78), Marshfield estate; surveyor to U.D.C.

GRAVESEND.—Employment exchange, for H.M. Office of Works, King Charles Street, London, S.W. (returnable deposit of £1 1s.).

GREASBROUGH (Yorks.).—Housing scheme (50), for the U.D.C.; surveyor.

GREENHITHE (Kent).—Electric lighting installation, Parish Church; Rev. E. A. W. Topley, rector.

HASTINGS.—Shops and flats, Queen's Road; H. M. Jeffery, architect. Shops (2) and houses (9), for Bexleigh Estates, Ltd., Bexhill Road; H. Ford, architect.

HOYLAND.—Senior school (600 places); West Riding E.C.

HULL.—Rehousing scheme, Aldbro Road improvement area; elementary schools at Hall Road, Westcott Street, and Rustenberg Street; conversion of Springhead Hall into golf club house; city architect. Development of building estate, off Gillshill Road; A. L. Windross and Partners, Ltd.

HURDSFIELD (Cheshire).—Electric lighting installation, Holy Trinity Church; incumbent.

HURLFORD.—Housing scheme (58), for Ayrshire C.C.; T. C. Stewart, Clydesdale Bank Buildings, Kilmarnock.

INVERNESS.—School at Inverlochy, Fort William, for Inverness County Education Authority; master of works, 11, High Street.

ISLE OF WIGHT.—Reconstruction of Royal County Hospital (£11,189); J. Ball & Sons, builders, Cowes.

KINGSTON-ON-THAMES.—Extensions, Grange Road, for the borough E.C. (£12,918); W. H. Gaze & Sons, builders.

KILMARNOCK.—Housing scheme (100), for the T.C.; burgh surveyor.

LONDON (Stoke Newington, N.).—Town hall (£92,000); B.C. Special Committee.

(Islington, N.).—Houses (113), Warltersville estate; Eadie, Towers & Co., Wolverhampton.

(Camberwell, S.E.).—Extensions, Grove Hospital, for the M.A.B. (£18,705); J. Crewsdon, Horley.

(Bermondsey, S.E.).—Factory extensions, Weston Street and Market Street; Geo. Parker & Sons, Ltd.

(Surbiton, S.W.).—Pumping stations, for the M.W.B. (£70,000); A. R. Turner, 30, Bedford Square, W.C., quantity surveyor.

(Ealing, W.).—Houses (261); H. S. Bostock, architect. Petrol station, showrooms, and maisonettes (over), at Gunnersbury Avenue; Hoare & Wheeler, architects, 22, Portman Street, Portman Square, W.1. Houses (76) and garages (46), Whitton Avenue; P. H. Edwards, Ltd., 237, Golders Green Road, N.W.11. Alterations and additions to Palladium Cinema, The Broadway; W. L. Trent, 123, Regent Street, W.1.

LOUTH.—Additional housing scheme (104), for the T.C.; borough surveyor.

LOWESTOFT.—Elementary school, Kirkley Run, for the E.C.

MAUCHLINE.—Housing scheme (32), for Ayrshire C.C.; T. C. Stewart, Clydesdale Bank Buildings, Kilmarnock.

MOTHERWELL.—Garage at Wishaw, for Messrs. Stewart and McDonald; the manager.

ORSETT (Essex).—Surgical block (£13,350), for the B.G.; clerk.

PONTEFRACT.—Housing scheme, Airedale (48), for the R.D.C.; Tennant & Smith, architects, Ropergate (returnable deposit of £2).

REIGATE.—Electric lighting installation, portion of institution, board room, &c., for the Board of Guardians; clerk.

ROTHERHAM.—Block of shops, Swallownest, for the Co-operative Society; secretary. Shops (12) and offices (£30,000), for the T.C.; borough surveyor.

SKIPTON.—Extensions, Grammar School (£21,000); West Riding county architect, Wakefield.

SOUTHEND-ON-SEA.—Two senior schools (£44,000) and school, Wentworth (£50,500), for the borough E.C.; J. Sargent, director of education.

SOUTHPORT.—Extensions, King George V School, for the borough E.C.; director of education.

STOKE-ON-TRENT.—Extensions, maternity home (£35,000); medical officer of health. Extensions, isolation hospital; W. H. Ward, architect.

SUNBURY.—Additional 100 houses, for the U.D.C.; surveyor.

SUNDERLAND.—Hospital (120 beds); Henderson Bros., builders, South Shields.

SWANSEA.—Houses (50), Manselton estate; Sir C. Mansell.

THORNE.—Elementary school (£34,500); West Riding county architect, Wakefield.

TILSTON FEARNAL (Cheshire).—Electric lighting installation, Parish Church; vicar.

TORQUAY.—Development, building estate, Park Hill Road; Stanley Richards & Co. Bandstand and enclosure (£55,000), for the T.C.; borough surveyor. Municipal buildings; Bridgeman & Bridgeman, architects.

WALTON.—Electrically-equipped pumping station at the sewage works, for the Reigate R.D.C.; Bertram Kershaw, engineer.

WEST RIDING.—School, Mitchell Memorial Homes (£24,000); West Riding E.C.

WOLVERHAMPTON.—Hotel, Merry Hill (£7,000), and grammar school extensions (£14,000); T. W. Edwards and Sons, builders, Stourbridge.

WORCESTERSHIRE.—16 senior schools (£325,000) and five junior schools (£30,000); alterations to 14 other schools; County E.C.

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The ELECTRICAL REVIEW

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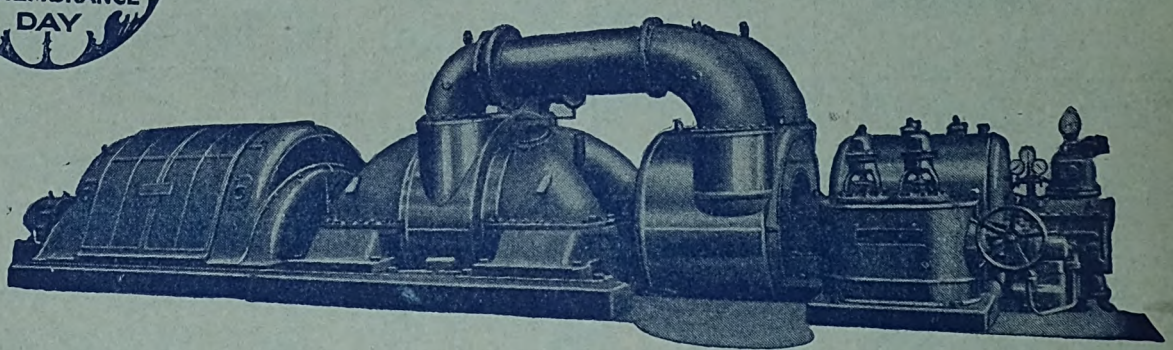

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The
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Electrical Communication.

WHEN progress in electrical engineering comes under discussion, it is generally its "heavy-current" applications that occupy most people's thoughts. Spectacular as recent advances in that division of the science have been, we think Col. Sir Thomas Purves, in his presidential address to the Institution of Electrical Engineers last week, fully substantiated the claim that achievements in "light-current" engineering bear comparison with those of any other branch.

The developments that have taken place during the seven years which have elapsed since electrical communication last formed the matter of a presidential address came, we think, as a surprise to many electrical engineers not directly concerned with the subject. The address delivered in 1922 by Mr. Frank Gill, O.B.E., may be regarded without exaggeration as epoch making, since the proposals then put forward, backed by the energy of their author, had as their direct result the formation of the C.C.I. and the pooling of international experience in telephone work, with consequent far-reaching technical effects. The extent of recent developments may be illustrated by the fact that seven years ago telephone communication with the Continent was possible only from London to Paris and Brussels, whereas one can now speak from anywhere in Great Britain to nearly 90 per cent. of the telephone stations of the world.

Sir Thomas Purves presented his special subject in so lucid a manner as to make it of the greatest interest to the enlarged audience, represented by nine local Centres, to whom his address was relayed. We hope that such relaying may become the standard procedure with regard to the presidential addresses of the future.

An illustration used by Sir Thomas to indicate the improvement in speech transmission through the use of repeaters suggests the thought that revision is necessary in the definition of an engineer as "one who most efficiently utilises the resources of Nature." May he not in some respects be said to have more than "struck a balance" with Nature?

One more aspect of the President's address can be mentioned here, and that is his very sound view that the fundamental technique of science and engineering,

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and its general applications, furnish more than sufficient material for a full college course. The student should therefore devote his time entirely to equipping himself with basic knowledge, which he will have little opportunity of acquiring in later years. This basic knowledge will increase his personal potentialities and his aptitude to acquire and use the special knowledge which experience in the industry will show him to be necessary. We may add that little of the recent progress in telephony could have taken place under men who had relied mainly on practical training—however great their aptitude may have been—to deal with new situations as they arose.

The Battersea Site.

It is, we believe, probable that the question of the proposed generating station at Battersea will shortly be brought to the notice of the House of Commons. It will be remembered that though local authorities in the neighbourhood of the site have decided to promote a private Bill to rescind the consent of the Electricity Commissioners for the first installation of 130,000 kW, on the ground of possible damage to property by emissions from the station, the work on the plant and site is now well advanced, and we think it highly unlikely that a Bill of this nature would ever receive Parliamentary sanction, but the danger is that the agitation will give an impetus to objections to the extension of the station when this becomes necessary for the supply of electricity to London. The Electricity Commissioners and the Central Electricity Board have come to the conclusion that a station is required at Battersea of a capacity three times that now sanctioned, and it is difficult to see how the needs of London can be met otherwise. Moreover, in laying down a large power station, constructional and civil engineering works are usually undertaken having in view the ultimate capacity, thus making the capital cost per kW on the first instalment of plant disproportionately heavy.

It is, of course, not disputed that Battersea is a favourable site from the technical point of view; the doubts that have been expressed by many disinterested people relate to its suitability from the social aspect. Until lately there appeared to be no commercially practicable cure for the sulphur di-oxide trouble, though the grit problem seemed capable of a not too expensive solution, but the London Electric Power Co. has now expressed confidence in its ability to avoid injurious emissions. Others have been working on the same problem, and Mr. P. J. Robinson, city electrical engineer of Liverpool, is also understood to have invented a satisfactory and reliable method of overcoming these difficulties.

The London Electric Power Company can safely be trusted to leave no means untried to avoid offence in this way, since failure to do so would probably result in the restriction of the size of its station to 130,000 kW, a limitation which would seriously hamper the company's scope.

There is every indication, therefore, that before the first two sets are in operation, means will have been devised to meet all legitimate objections to the Battersea site. To think otherwise is to despair of the ability of engineers and chemists to meet their technical obligations, and to confess to the defeatist view that the resources of science are exhausted, in an age that has to place its trust in scientific development in every way of life.

The Russian Report.

Considerable interest was manifested when the Anglo-Russian Committee organised a trade delegation to visit Russia earlier this year and to report upon conditions and prospects in that obscure country. This interest should be revived by the publication of the delegation's report, a review of which appears in this issue.

The picture drawn by the report is purely an industrial one; it says little of life under the Soviets. It is a picture of a nation doing its best in novel and difficult circumstances, its isolation constantly hampering its development.

This isolation has precluded the free interchange of technical knowledge and skill with the outer world in consequence of which Russian industry is very inefficient measured by the standard of production costs, although some of the factories are equipped with the most up-to-date plant. Hence the need for the interchange of personnel and experience with other industrial countries which the Government seeks to secure by offering concessions. The concessions already operating appear to be remunerative; indeed, the concessionaire is accorded very favourable terms all round.

Above all, however, Russia needs capital and credit. But the repudiation of obligations incurred under the *ancien régime* has engendered considerable hesitancy in those with money to invest, and some settlement of this problem must be reached before the doubts are cleared away. The delegation appeared to find a disposition on the part of the Soviet Government to discuss this matter with properly accredited representatives of the British Government. No doubt if an agreement was reached the banks would be willing to take a hand in the financing of contracts necessitating long-term credits, and probably the Government's Export Credits Scheme would be extended to Russia and expanded to meet the large sums which would be involved.

Apparently nothing can be done on a large scale until diplomatic relations are resumed between Great Britain and Russia. Mr. Piatakov definitely stated that in the existing circumstances Russia was only purchasing from this country supplies that were obsolutely necessary. He held out the prospect (or bait, according to the point of view) of considerable business if relations were fully restored. No doubt this subject will be thrashed out in the House of Commons when Mr. Henderson reports the results of his recent conversations with Mr. Dogalevsky. It is to be hoped that something definite will be the outcome of the report and the above-mentioned conversations, for other countries are taking increasing interest in Russia, and we cannot afford to lose any business which can be obtained with a reasonable measure of security.

German Electrical Leaders' Dispute.

The recent public controversy between the leaders of the two largest German electrical concerns was productive of some very candid criticisms from both sides. Adopting a nautical style, Dr. C. F. von Siemens implied that the A.E.G., in allowing Americans to take up a large parcel of its shares, was handing over the control of the ship to a not altogether disinterested pilot. While he admitted that it was necessary to call in foreign financial aid, he was convinced that the industry could pull through its difficult period without losing its German character.

The A.E.G. indignantly repudiated the suggestion that it was subjecting itself to German control. Siemens agreed that the industry had to have foreign capital, and the only question was whether this should take the form of bonds or shareholdings. The A.E.G. reminded Dr. Siemens that his company had no objection to American participation in the Osram Co. in which both the A.E.G. and Siemens were interested. It was presumed that Dr. Siemens had a motive in making his attack. The A.E.G. had refused to form a monopoly in the German telephone industry with Siemens & Halske, and in the meantime foreign capital had obtained an influence over the smaller German telephone concerns. The A.E.G. had agreed to co-operate with the American company as the latter was the most important of its kind in the world and could aid German progress. A report of the two statements appears in this issue.

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Electricity Supply at Oldham.

A description of the new municipal generating station at Slacks Valley, Chadderton, which was officially inaugurated on October 16th.

THE public supply of electricity at Oldham was commenced in 1894, when the Rhodes Bank station was opened with a plant capacity of 192 kW. Extensions from time to time brought the capacity of the station up to 1,532 kW in 1900. In 1902 a second generating station was established at Greenhill with 3,700 kW of plant, and the system was run with the two stations with a total plant capacity of 5,232 kW.

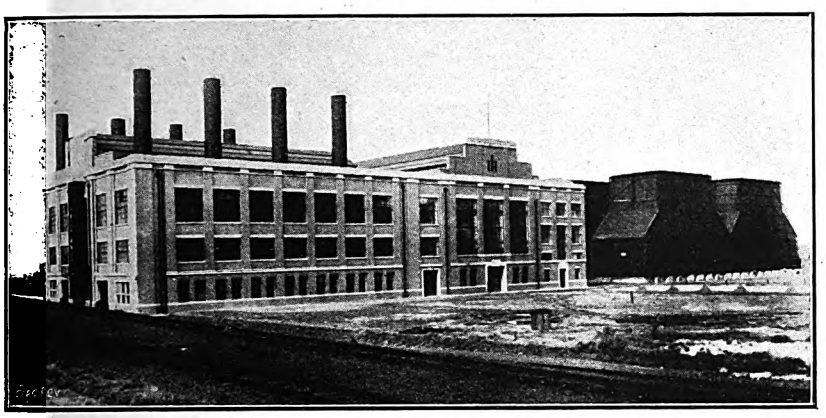

Fig. 1.—Slacks Valley Generating Station.

After the transfer of some 440 kW of plant to Greenhill, the Rhodes Bank station was closed down in 1909. During the latter part of the war very considerable increases in the demand necessitated extensive alterations to the station being carried out, and new and up-to-date machinery was installed. The plant capacity of the station in 1921 amounted to 12,400 kW. Further periodical extensions have brought the station up to its present capacity of 32,000 kW. When the question of further extensions came up, it was decided that the station had reached the economic limit of plant capacity, and that a new station should be built at Slacks Valley, Chadderton.

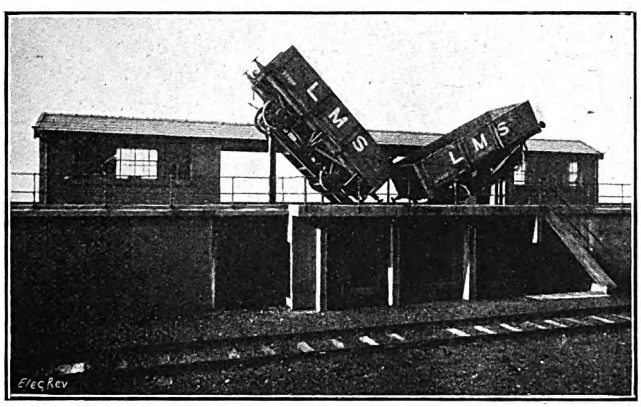

Fig. 2.—Ram Tippers and Receiving Hopper.

Sanction to erect this station was given by the Electricity Commissioners in 1925, and October 16th saw the culmination of the project in the official inauguration of the first section of the station by Councillor Charles Hordman, J.P., chairman of the Oldham Electricity Committee (see our last issue, p. 721). The station is designed for an ultimate installed capacity of 150,000 kW.

Fig. 11 is a view of the station during the early construction stages. It is of particular interest in that it shows the result of a violent storm which twisted some of the roof girder work.

The new works, fig. 1, is built on land adjoining the main line of the L.M. & S. Railway from Manchester to Yorkshire on the west and the Rochdale Canal on the east, the entrance being on the new Manchester-Chadderton arterial road. The site covers an area of 34 acres. The ground on which the station is built offered somewhat difficult problems of foundation construction; the top surface was a layer of peat with plastic clay and sand below, which necessitated the use of a large number of concrete piles for both the main building and the water-cooling towers.

It will be possible to transport coal from the Lancashire coalfields by way of the Rochdale Canal, whilst two short siding connections to the L.M. & S. Railway on the west side have put the works in direct communication with any railway in the country.

The coal wagons are dealt with on the sidings by a fireless steam locomotive and electric capstans. One rail track passes over two railway-type weighing machines and the coal-receiving hopper, so that each waggon is weighed before and after emptying. The coal is unloaded by means of two electrically driven ram tippers placed between the rails and discharged into the receiving hopper below, fig. 2, whence it is carried by means of an automatic filler into an endless-chain gravity bucket conveyor, capable of dealing with 80 tons of coal per hour, to the main storage bunkers over the boiler house, fig. 5; these have a total capacity of 900 tons. A special feature of the coal-handling plant is an auxiliary conveyor which is used for the recovery and return to the main bunkers of riddlings and fine coal which accumulate below the chain-grate stokers. This conveyor

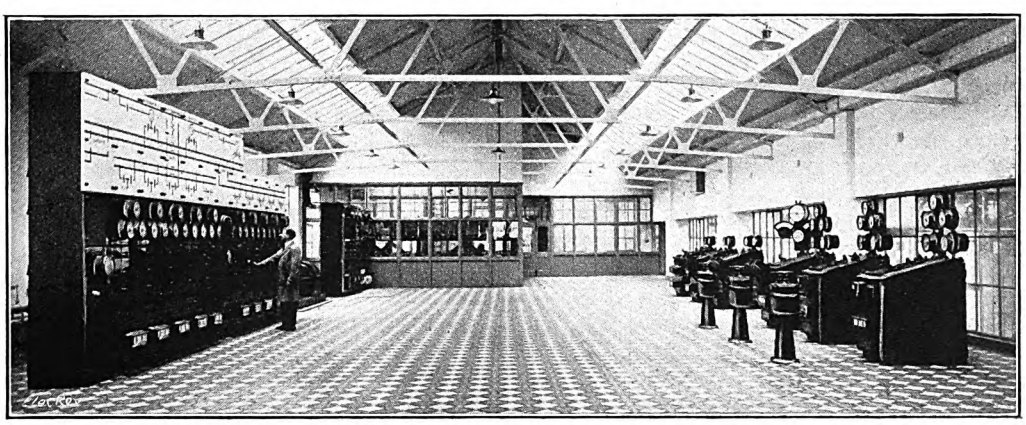

Fig. 3.—The Control Room.

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has a capacity of 5 tons of fine slack per hour. The station proper consists of the turbine house, 143 ft. long by 70 ft. wide by 60 ft. high to the eaves of the roof; the boiler house at right angles to the turbine room,

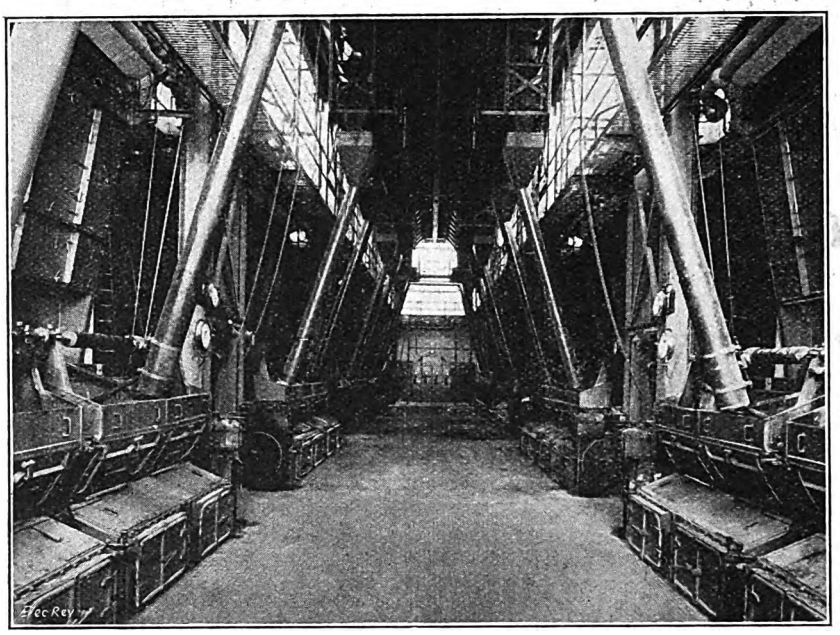

Fig. 4.—Boiler House; Firing Floor.

140 ft. long by 120 ft. wide by 53 ft. high to the eaves; a three-storey switch house parallel with the turbine building; a feed-pump house situated between the turbine and boiler sections; and a block of offices at the permanent end of the switch house.

The buildings are of steel framework with brick filling, the exterior of the walls being faced with Accrington brick and Yorkshire stone.

Every effort has been made to provide good natural lighting, and this is particularly noticeable in both the boiler house and condenser basement. The basement of the boiler house is arranged at ground level, and a horse-shoe track enables the ashes to be directly removed from the hoppers beneath the boilers by motor or railway wagons and tipped on the site. Fig. 13 depicts the layout of the plant.

The steam-raising plant consist of eight 50,000-lb. cross-tube, marine-type, water-tube boiler units, fig. 4. These are designed for steam conditions of 295 lb. per sq. in. and 700 deg. F.

Each boiler set is entirely self-contained, and includes a vertical, cast-iron, steel-cased economiser, an electrically driven induced-draught fan, and a steel chimney, 7 ft. in diameter and 80 ft. high.

To obtain as much natural light as possible, and for ease of maintenance, the economisers have been placed immediately behind the boilers on an auxiliary floor, and the induced-draught plant has been arranged immediately underneath the economisers at the firing-floor level. This results in an unusually neat and clean arrangement, as is evidenced by the daylight photograph reproduced as fig. 6.

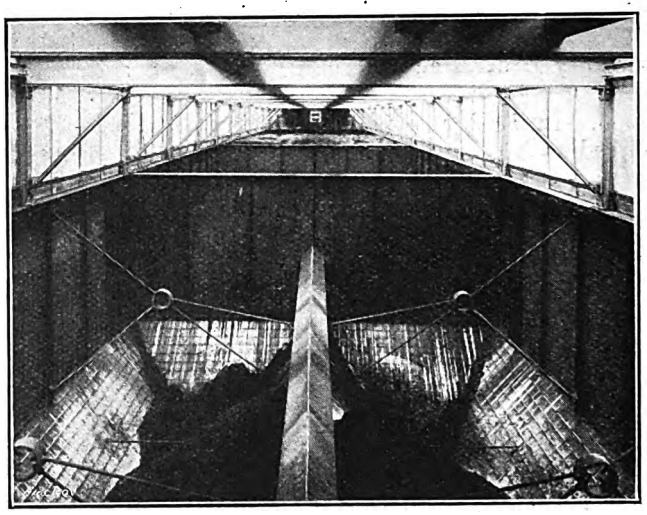

Fig. 5.—Main Coal-storage Bunkers.

The coal from the main bunkers passes through two 2-cwt. "Avery" weighing machines and traversing-type chutes to the stoker hoppers. The boiler furnaces are fitted with automatic mechanical chain-grate stokers, each boiler having two grates with a total grate area of 324 sq. ft. per furnace. Although the stokers are arranged to operate under simple induced-draught conditions, arrangements have been made so that the necessary closing-in plates can be readily added in order to install forced-draught and air-heating plant for operating the stokers under balanced-draught conditions if necessary. Steam soot blowers are provided for both the boilers and economisers. Each boiler is equipped with the necessary instruments for the maintenance of high efficiency. There are six boiler feed pumps, fig. 8, with an aggregate capacity of 95,000 gal. per hour. Four of the pumps are electrically driven and two steam driven. The exhaust steam from each turbine pump is led to a feed-water heater arranged in the feed-pump suction.

Four condensate surge and make-up water tanks are erected in the upper portion of the pump house. Under ordinary working conditions the extraction water passes direct from the condensers to the feed pumps and thence back to the boilers. By means of suitably arranged by-pass valves a "Lea" recorder can be brought into operation. One of the condensate tanks can be isolated at any time to take the condensate from any one turbine set which is required to be run on load under test conditions. The discharge from this tank can be passed to the tank erected on a weighbridge on the pump house floor, so that the whole of the condensate can be weighed. The weighed water is returned, *via* another tank in the condenser basement,

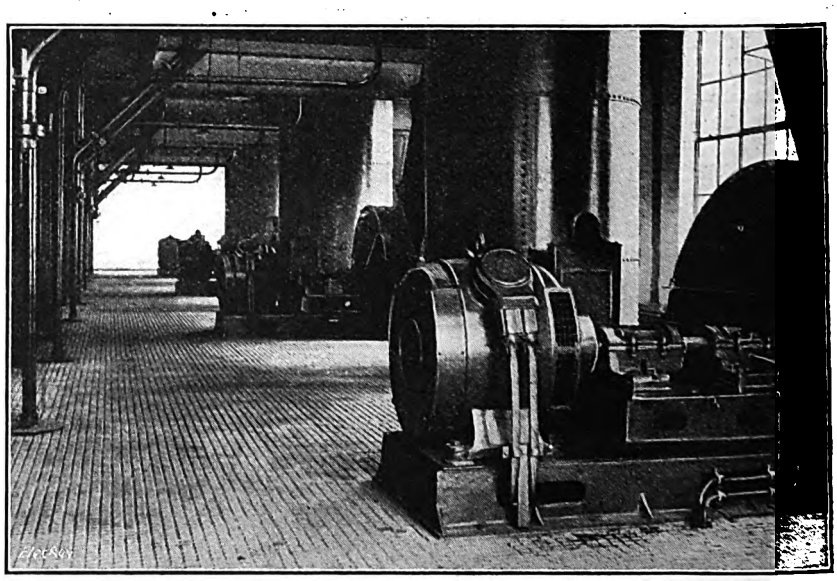

Fig. 6.—Induced-draught Fans; Under Economisers.

to the common feed system. The boiler make-up water is obtained from the town supply, and a "Permutit" water-softening plant is installed to deal with it. Every effort is made to conserve water; the land on the station

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site is drained into a small reservoir, and the whole of the works drainage throughout the station is collected in a suitable tank in the basement.

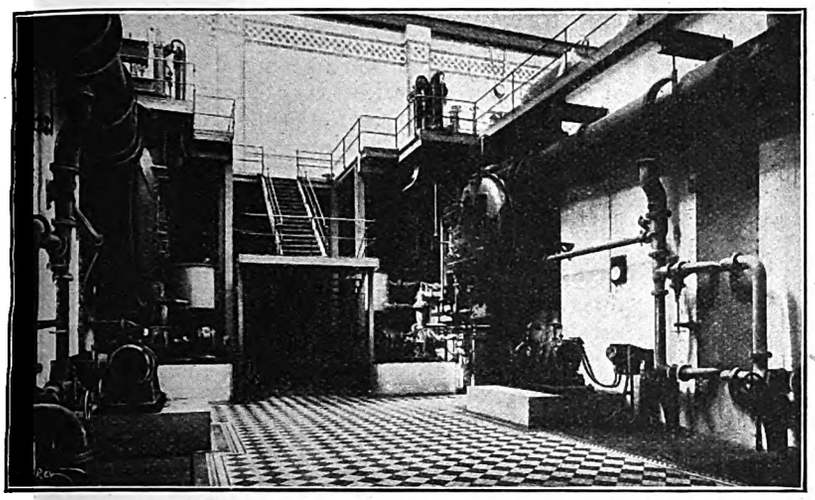

Fig. 7.—View in Condenser Basement.

In the turbine house, fig. 9, there are three turbo-alternator sets, each capable of giving a normal output of 12,500 kW, with an overload capacity of 25 per cent. for two hours, 6,600 V, 3,000 r.p.m. Each turbine is of the two-cylinder type and designed so that only steel is exposed to high-temperature steam. Four comparatively small-diameter pipes provide a flexible connection from the steam chest to the turbine cylinder, and pipes with corrugations are arranged on each side of the machines to give flexible connections between the two cylinders. The low-pressure cylinder is made of cast-iron and incorporates a number of Rateau impulse stages and "Baumann" multi-exhaust. Arrangements are made for the electrical remote speed control of the turbines from the control room. The turbines are arranged for two-stage feed heating. The oiling system of each turbine is complete with pump, tank, coolers, and centrifugal separator, and arrangements are made so that the separator can be put into service whilst the turbine is on load. The alternators are each capable of a continuous normal full-load output amounting to 12,500 kilowatts at 0.8 power factor. Each exciter is directly coupled to its alternator and is of the overhung type. Each alternator is ventilated on the closed air circuit system, with rotor and external fans, the coolers for each alternator being arranged in two units situated directly beneath the alternator and enclosed by the foundations.

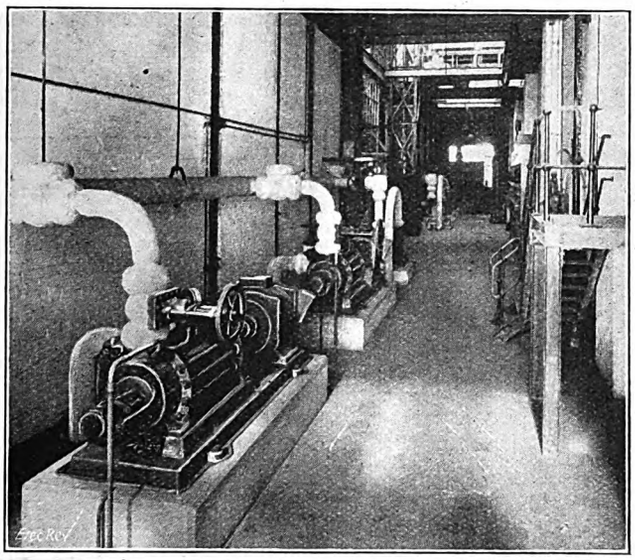

Fig. 8.—Boiler Feed Pumps.

The condensers are of the central flow, surface type. Each is fitted with an extraction pump, a rotary air pump, a stand-by steam-operated air ejector, and circulating-water pump. Each condenser has a cooling surface of 16,600 sq. ft. Fig. 7 is a view in the condenser basement. The extraction pump discharges through the feed heaters direct to the suction of the boiler feed pumps. A steam-operated air exhauster serves each condenser to facilitate obtaining a good vacuum quickly when starting up. The four circulating-water pumps, fig. 10, are arranged for interconnection with any of the generating sets, and each will deliver 15,690 gal. of water per min.

The condensers, air coolers, and oil coolers are all protected against electrolytic action by means of the Harris Anderson anti-corrosion system, the "opposing" current being supplied at 25-V from a small motor-generator set. The condensing water is dealt with in three duplex water-cooling towers, having a total capacity of 1,800,000 gal. per hour. In addition, sufficient condensing water for one 12,500-kW set can be obtained from the canal on the east side of the station. It is intended to obtain the make-up water for the cooling-tower evaporation from filtered sewage effluent from the Corporation's sewage works on the other side of the canal.

A feature of general interest is that compressed air is available at various points all over the station for such operations as blowing out motors and other machines, instead of using portable blowers.

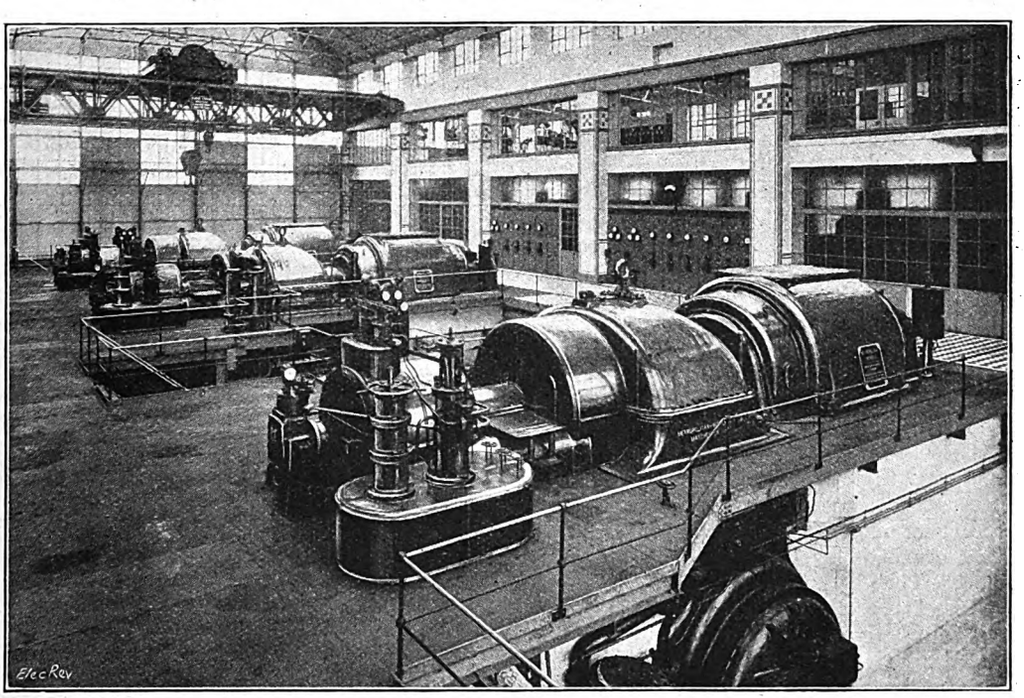

Fig. 9.—Turbine House; Three 12,500-kVA Sets.

The main 6,600-volt switchboard (six units, fig. 12) right, is of the duplicate-busbar, electrically operated

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drawout metal-clad type, and controls the three alternators, two five-group feeders, the transformers, and the works auxiliaries. Each generator unit is provided with two triple-pole oil circuit breakers, each having a rupturing capacity of 1,500,000 kVA, so that the machine may be connected to either busbar. Two double-circuit units feed two 5-unit remote electrically operated subsidiary feeder switchboards, fig. 12, left, whilst the remaining unit feeds a 3-panel electrically operated duplicate-busbar stationary cubicle-type switchboard for controlling the h.p. side of the 1,000-kW, 6,600/440-volt station transformers. The circuit breakers on this switchboard have a rupturing capacity of 250,000 kVA. The group-feeder circuit breakers connected to the front busbars feed direct on to the front busbars of the subsidiary switchgear, and similarly the rear breakers feed direct on to the rear busbars of each subsidiary board. One of the feeders on each of the subsidiary switchboards serves as an interconnector with the Greenhill station. The star points of the alternators are connected to a three-panel electrically operated cubicle-type selector switchboard, the busbar of which is connected by means of cable to a grid-type earthing resistance which is arranged to pass 1,000 A for 30 sec. The alternators are fitted with self-balanced protective gear interlocked with the field-suppression pillars, so that the latter function when the breakers open under internal-fault conditions only. Stand-by definite-time-limit overload protection is also provided. The group-feeder circuits have triple-pole over-load protection, the relays being arranged with those on the subsidiary feeders, so that on the occurrence of a fault beyond the breaking capacity of the sub-feeder switches, this would be dealt with by the main group feeder breakers. The low-pressure transformer circuits are fitted with t.p. over-current trip coils with time-limit fuses, and the radial feeders have d.p. over-current and leakage protection. The control and relay equipment for the main switchgear is mounted on separate desk-type control panels, fig. 3, right, and that for the subsidiary switchgear on flat-back panels with rear access doors, fig. 3, left. The whole of the subsidiary equipment is surmounted by an automatic indicator board giving a single-line diagram of the main electrical connections of the station. Mounted separately in the same room is a combined control board for the e.h.p. works power switchboard and for the control battery switchgear. A 180-Ah Tudor battery in an annexe to the control room is available for energising the closing and tripping circuits, and also for emergency lighting in the station.

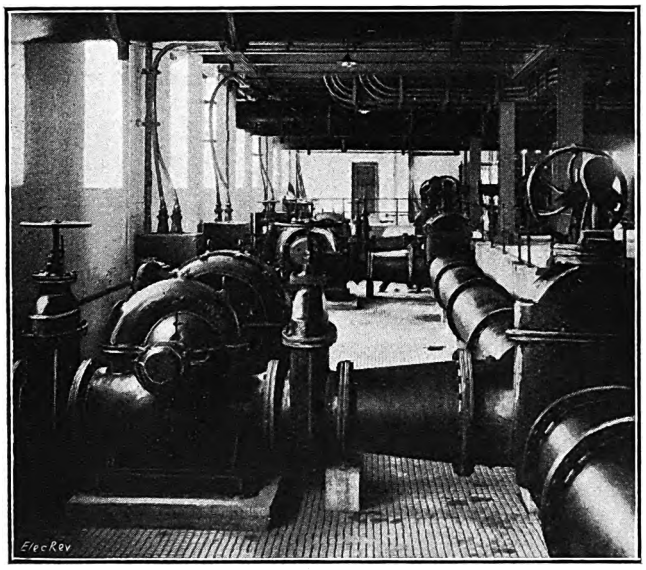

Fig. 10.—Condenser Circulating-water Pumps.

Synchronising facilities are provided on the generators, the group feeders and the interconnectors on the subsidiary switchgear, so that, according to the conditions, the operator can synchronise on the interconnector switch or on the group-feeder switch. A bell alarm system is also embodied and operates when fault current is flowing through the earth-limiting resistance or whenever a breaker on the switchgear or subsidiary switchgear trips under fault conditions. The metal-clad switchgear is of the vertical-isolation type, with motor-operated raising and lowering gear.

An interesting feature of the main switchgear is that each phase has a complete non-magnetic earthed metal enclosure throughout, so that should any faults develop they would be earth faults only, the fault current being limited by the neutral earthing resistance. The metal-clad voltage transformers have their own isolating features, so that work can be carried out on them without disturbing the main circuit.

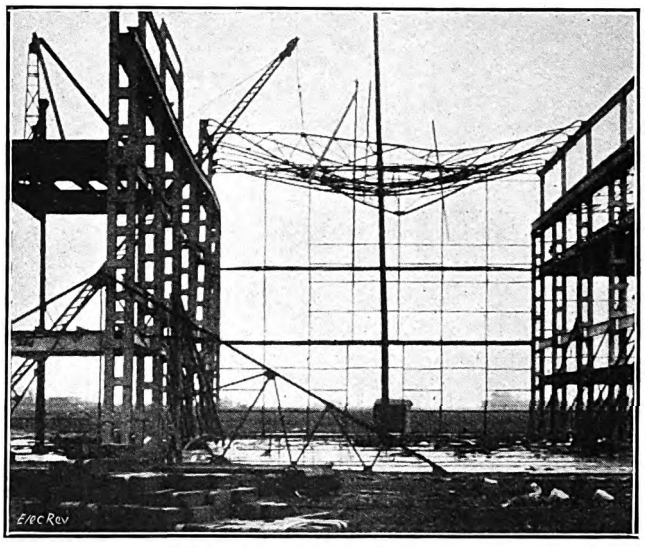

Fig. 11.—"Progress" Photograph; after a Storm.

The following are the contractors and sub-contractors for the more important items of equipment:—Boilers and superheaters, Messrs. Babcock and Wilcox, Ltd.; economisers, Messrs. E. Green and Son, Ltd.; induced-draught fans, Messrs. Davidson and Co., Ltd.; fan motors, Lancashire Dynamo & Motor Co., Ltd.; motor switchgear, Brookhirst Switchgear Co., Ltd.; instruments, Cambridge Instrument Co., Ltd.; steam flow meters, Messrs. George Kent, Ltd.; turbo-alternator plant, Metropolitan-Vickers Electrical Co., Ltd.; circulating pumps, Messrs. Mather and Platt, Ltd.; transforming plant, English Electric

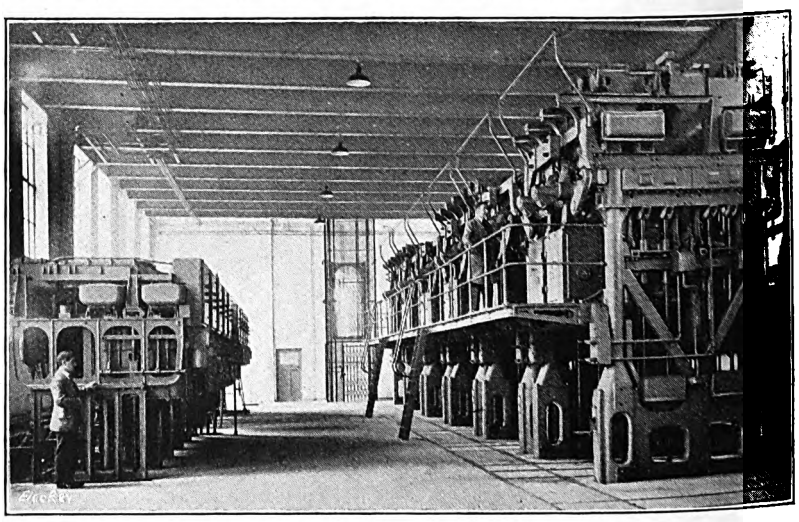

Fig. 12.—Main and Subsidiary 6,600-V Switchgear.

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Co., Ltd.; switchgear, Messrs. Ferguson, Pailin, Ltd.; battery, Tudor Accumulator Co., Ltd.; coal-handling plant, Messrs. Babcock & Wilcox, Ltd., Messrs. W. Hodgson, and Messrs. W. & T. Avery, Ltd.; pumps, Messrs. G. & J. Weir, Ltd., and Messrs. Mather & Platt, Ltd.; pump switchgear, Messrs. Allen West & Co., Ltd.; cables, Union Cable Co., Ltd.; cooling towers, Premier Cooler and Engineering Co., Ltd.; screening plant, Messrs. F. W. Brackett & Co., Ltd.; and water softener, United Water Softeners, Ltd.

The station has been designed by, and erected under the supervision of, Mr. Robert Blackmore, A.M.I.E.E., consulting engineer, in close co-operation with the borough electrical engineer, Mr. F. L. Ogden.

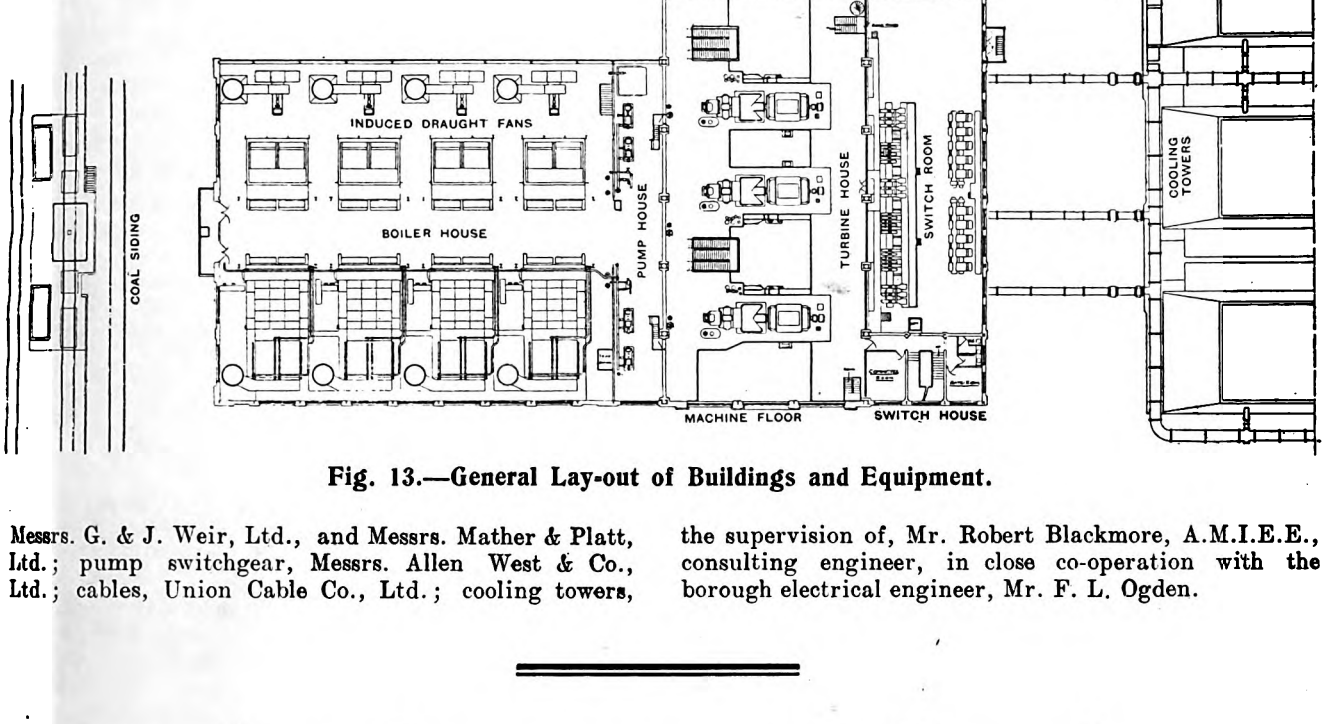

Fig. 13.—General Lay-out of Buildings and Equipment.

An Impetus to Rural Electrification.

Some practical comments on electric ploughing and the impellent needed to stimulate the general use of electricity by the farming community.

By THEODORE STEVENS, M.Inst.C.E., M.I.Min.E., M.I.E.E.

(*Concluded from page* 649).

It is a comparatively simple matter to erect a distribution line along hedges or fences, using foresight to ensure facility of work in every field that may require it, so that the length of travelling conductor will reach the remotest corner. If, by further careful designing, practical means are provided for using motor power for moving the plough parallel to the furrow when it reaches the end of its run without turning around (*i.e.*, without using the steering wheel) the work will be reduced to what a single ploughman, without especial skill and without physical efforts, can easily accomplish. This must appeal forcibly to the practical farmer, as it both simplifies his problem of getting men to do the work and cheapens it. The physical effort and skill demanded at headlands when manipulating an ordinary plough occupy time and use up energy that can be profitably spent in more useful directions.

An ounce of practical experience is worth a pound of talking.

The accompanying map, fig. 1, is reduced from two ordnance "Haddingtonshire Sheets V, West," and on it each field to be ploughed has its acreage marked. The farmer has erected a three-phase distribution line where marked by a row of x's, using locally grown poles injected with "Cobra" preservative compound. The southern branch on this farm is located along a boundary with a view to ploughing part of an adjacent farm. The central position of the three-phase transformer is shown, also the supply line bringing current at higher electrical pressure. The writer knows of no other farm so well equipped for electricity distribution, and puts this map forward as a model. The frame to the map is made up of 1,000-feet lengths, clearly indicating that no point in any field to be ploughed is more than 440 yards from the distribution line.

Let us consider the electricity supply authority's point of view:—The map shows 285 acres to be ploughed. This is daytime work and will consume not much less annually than 7,000 kelvins, which does not include power that will be consumed in threshing grain,[1] shearing sheep, and "cultivating" land. Cultivating can be done at any angle to plough furrows up to 45 degrees with the distribution line.

Is there a supply engineer who would not provide this daytime power at a very moderate price per kWh?

Those who have inspected the Waggithal scheme, which works between midnight and 5 a.m., utilising power from water that otherwise must flow to waste, have seen at how low a cost per kWh such off-peak energy can be sold, and at a profit.

From the distribution lines on the map a flexible cable containing conductors and an "earth" wire (a safety device against electric shocks, connected to the frame of

[1] Committee on Relation of Electricity to Agriculture. *Bulletin*, Vol. IV, No. 1, p. 117, January 30th, 1928, gave power consumed in threshing barley 0.159 kelvin per bushel, oats 0.141, wheat 0.265, in Wisconsin.

ibid p. 113. Sheep-shearing by hand, 8 minutes per sheep one man; by electric power 4 minutes per sheep, using one kelvin for 40 sheep.

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the plough and tractor) free-wheels to the pull of the machine (which never exceeds a few pounds tensile pull on the cable) and winds in slack cable by means of main motor power on the return run. Loose cable is never lying on the ground, and wear and tear are reduced to the absolute minimum. This flexible cable requires no man-handling.

The writer is not aware of any other ploughing outfit that possesses this great advantage. The credit for the conception and design, and for the method of side-stepping with power, not having to regain parallelism of the chassis because it is never lost, is due to Major A. McDowall.[2]

It is evidence of foresight and enterprise that such progress can be recorded, but how can we get electricity to every village and farm? When the Minister of

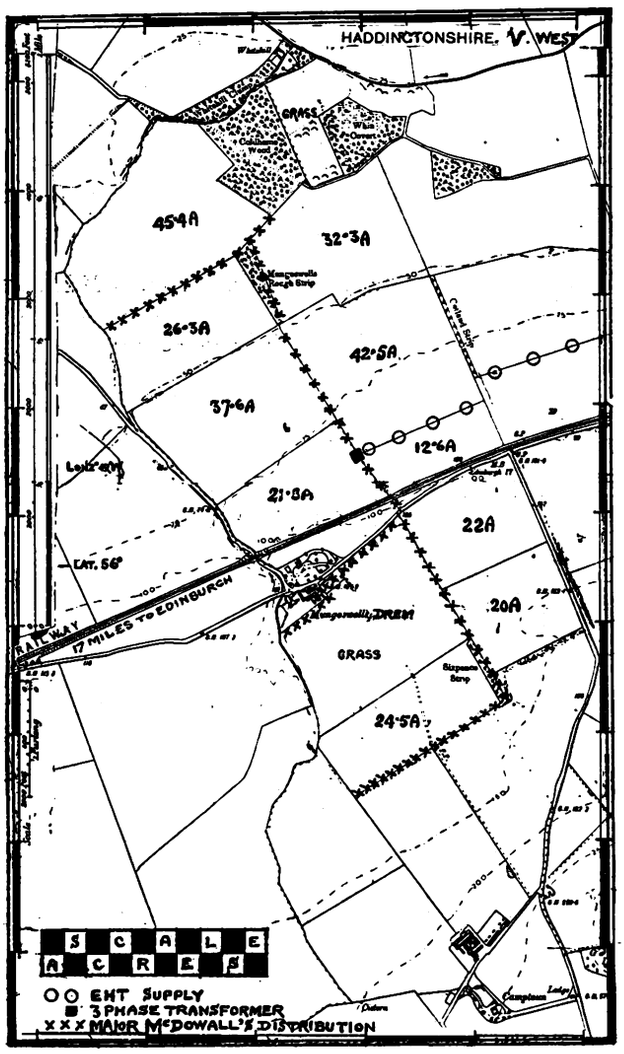

Fig. 1.—Electric Ploughing Lay-out.

Transport expressed the hope that he would soon assist in giving rural areas as abundant supplies as urban areas were then enjoying, a critic published figures of some sixty named places showing an average of 50 per cent. of urban homes unable to get electricity because mains were not within reach, and in some named places as many as 90 per cent. were without electricity.

The impetus needed everywhere is the provision of distribution to the homes and, so called, free wiring in the home, which actually distributes the capital cost over a period of years in a most practical way.

Battersea was reported (p. 10, *Daily Herald*, May 9th, 1929) to be doing this for every home. We wish them all a supply with reasonable promptness while realising that 15 per cent. of their 43,000 families then had electricity. In 1928 all London[3] had 300,000 consumers, and according to the 1921 census, 1,120,000 occupiers or families, which shows 73 per cent. without a supply.

[2] To "Implement and Machinery Review," September 7th, 1926, Major McDowall wrote: "The tillage load will be essential to the success of any truly rural distribution."

We would welcome the provision of capital by the State, or local authorities, for economically distributing to, and equipping, every home on as easy terms and with no more obligation to ensure a prompt return on the capital expended than is imposed on those installing the national "grid," and with no larger proportion of burden on the present generation. It would more promptly increase demand than the "grid" will; and, with increased demand, cheaper cost of production would follow and lower possible selling price. It would help to brighten many a dull life and everyone thus benefited could accomplish more.

But we must not appear to accuse rural dwellers of all the inertia, for some suppliers are equally slow.

We select one example from the latest *Garcke's Manual* of a supply commenced in 1905 in a population of over 11,000 which has, after 23 years, a connected load of 500 kilowatts and almost 300 consumers (12 added each year) while the Somerset House records show five directors to whom over £550 per annum, plus 5 per cent. on profits (after 6 per cent. dividend) is allocated out of income from sale of current at 8d. per kelvin for light and 4d. for other services. This is a high average per annum per consumer to pay for directors' fees.

Many companies are more progressive; we hope none are more grasping after maximum personal benefit for minimum service. "In a sane" industry situated as electricity is now "salaried incompetence or impotence must cease to exist."

The obstacle every distribution engineer finds in areas sparsely populated is the demand from his directors that he shall show in advance that he can earn a profitable return on the capital.

No one would think of blaming directors for so wisely protecting their shareholders. The national "grid" gets money cheaply. Cannot rural distribution throughout Great Britain receive similar encouragement and equally cheap capital?

[3] Table of Percentages:—

London.	Percentages of Families with no electricity.	Increase in consumers 1922 to 1928.	Number of families (Census 1921).	Number of consumers (Garcke).
Companies (by subtraction)	70%	—	544,325	164,528
Local authorities (named below)	76%	—	575,675	135,472
Total of above	73%	—	1,120,000	300,000
Southwark ...	95%	52%	46,727	2,391
Islington ...	87%	80%	89,424	11,318
Poplar	86%	104%	37,288	5,247
Battersea ...	85%	45%	42,988	6,530
West Ham ...	83%			
Hackney ...	82%	115%	56,020	10,270
Bermondsey ...	81%	176%	28,610	5,521
Stoke Newington	77%	120%	13,930	3,161
St. Pancras ...	77%	89%	56,653	13,166
Stepney ...	75%	172%	55,832	13,924
Fulham	72%	49%	40,436	11,450
Shoreditch ...	72%	198%	25,373	7,127
Hammersmith	66%	81%	33,263	11,111
St. Marylebone	33%	372%	27,214	18,005
Hampstead ...	24%	45%	21,520	16,321

Mines Report.

In the report for 1928 of Mr. J. M. Carey on the inspection of mines under the Coal Mines Act in the Cardiff and Newport area, attention is drawn to an explosion which occurred in a large horizontal drum-type oil-immersed controller, which formed part of the equipment of a main-and-tail haulage engine; fortunately no personal injury or fire resulted, but the inspector emphasises the potential dangers of such an occurrence and discusses the probable causes of the accident. Particulars of the numbers of safety lamps are included in the report, which is now on sale (post free 1s. 1d.) at H.M. Stationery Office, 1, St. Andrew's Crescent, Cardiff.

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Electricity for the Home.

Gravesend's Progressive Policy: Successful Hire-Purchase and Free-wiring Schemes: Opening of New Showrooms.

THE recent opening of electricity showrooms by the Gravesend Corporation gives us an opportunity of saying something about the great strides which domestic electrical development has made in that town.

In the first place, it may be said that Gravesend is in the outer suburbs of London and has a number of large and important industrial works; W. T. Henley's Telegraph Works Co., Ltd., has a big cable factory there, there are a number of cement works in the district, the Amalgamated Press has a large Gravesend printing works, and then there is the Imperial Paper Mills which supplies newsprint for a number of leading daily and weekly papers. Electrically Gravesend is prominent by reason of its low production costs which led to its classification as a selected station under the South-East England Electricity Scheme.

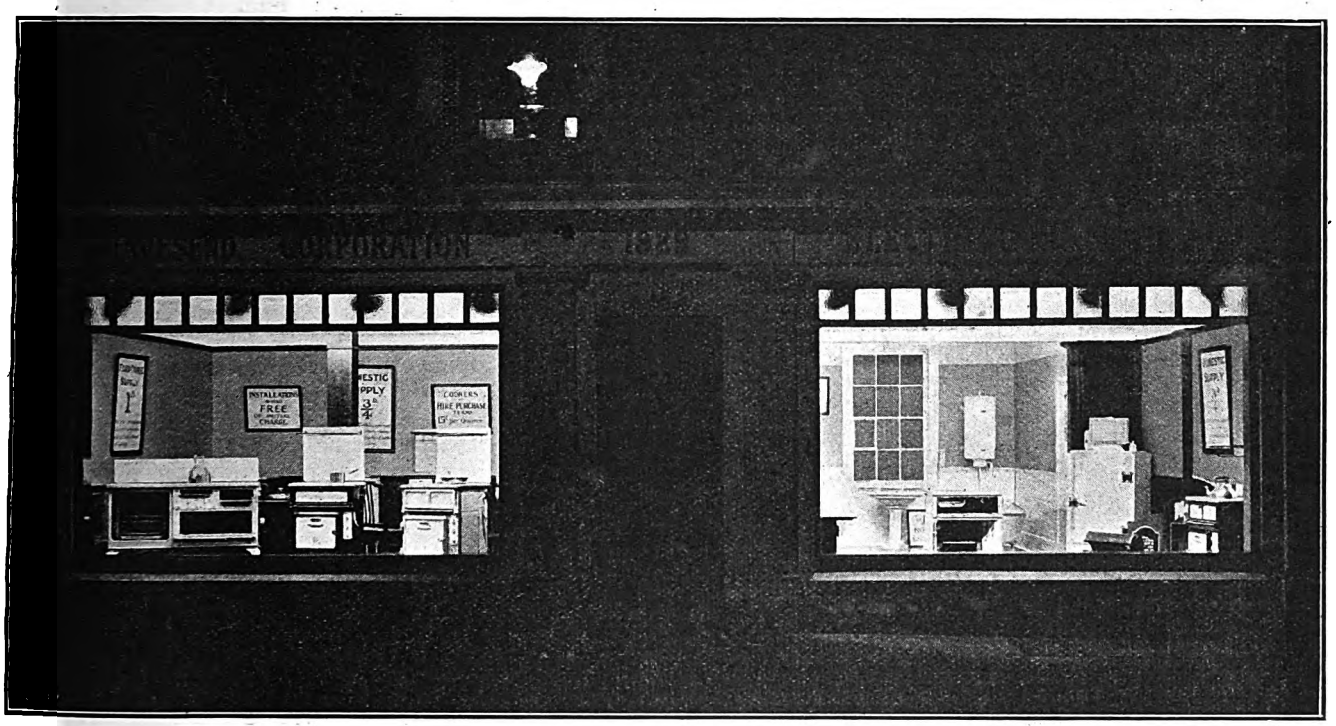

Fig. 1.—The New Gravesend Municipal Electrical Showrooms.

Gravesend has a population of 31,000, and Northfleet, which is in the area of supply, adds a further 16,000. There is accordingly ample scope for domestic electrification, and under the guidance of the borough electrical engineer (Mr. C. F. McInnes, M.I.E.E.) much has been done in this direction.

Gravesend was a pioneer in the matter of low charges for domestic electricity, and it has built up a substantial domestic load in consequence. The "all-in" rate consists of a fixed charge of 2½ per cent. of the ratable value per quarter, plus a "unit" charge of ¾d. The fixed charge is still based on the old rating assessments, but within the last year there has been an increase in the assessments of the majority of premises. It is hoped, however, that if the fixed charge is increased on that account it will be possible to reduce the running charge to ½d. per kWh. Mr. McInnes favours the ratable-value basis, as on the whole it works fairly; he is against any system which depends upon investigations by officials. It may be mentioned in parenthesis that electrical development is aided by the price of gas in the town, quarterly consumers being charged 1s. 2½d. a therm.

The encouragement to use electricity afforded by low prices is stimulated by the Department's "free wiring" scheme. Under this the work is carried out by approved contractors to a schedule at 25s. per point. Payment for the wiring is made at the rate of 2d. per kWh. Practically every new house is now wired for lighting, and the older houses are rapidly coming on to the system.

Mr. McInnes reports a great improvement in the load factor in the last year or two, due mainly to the greatly increased domestic consumption for purposes other than lighting. Electric cooking and water heating are greatly facilitated by the very favourable hiring scheme which the Department has in operation. The cookers employed are of "Jackson" manufacture. Several sizes are available, *viz.*, Nos. 52, 54, 56, and 58, for households comprising from three to fourteen persons. These cookers are eminently convenient and are capable of catering efficiently for the requirements of a family. The Department supplies them fitted with "Marblon" mottled porcelain enamelled hobs and fronts, thermometers, plate racks, and splash plates. We illustrate in fig. 2 the No. 56 model, a fairly large cooker capable of providing meals for ten persons. The oven measures 15½ in. by 15½ in. by 13¼ in. and has a loading of 1,950 W. There are two 8½ in. by 6 in. "Sadia" boiling plates, each loaded to 1,500 W and an 1,800-W grill element in the top of the hot-cupboard measuring 11 in. by 8 in. Under normal conditions the load does not exceed 60 per cent. of the total. The hire-purchase charge is the same for each size of cooker—15s. per quarter, and the consumer only pays the actual retail cost of the appliance. No interest is charged for the accommodation, the scheme being financed from a special reserve fund which has been formed for the purpose.

For water heating the Department supplies "Sadia" geysers of various sizes at a charge of 7s. 6d. per quarter. A typical geyser of this pattern is seen in fig. 3. The right-hand view shows the internal arrangements of the appliance. A commencement has also been made with the hiring of the "Jackson" wash-boiler. This has a capacity of 10 gal. and a loading of 3 kW controlled by a three-heat switch. If desired a "Perco-Wash" sprayer, which assists the washing action, can be fitted.

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The Service Department is in charge of Mr. Bond, the consumers' engineer, and all difficulties and breakdowns are rapidly attended to. Recently a hotel on the outskirts of the town telephoned to say that in the process of cooking breakfast for a large party of guests the cooker had broken down. The Department sent out immediately and remedied the fault, which was outside the cooker; the residual heat of the cooker kept things going in the interval, and there was no delay whatever.

For a considerable time past the question of an electricity showroom has been before the Town Council, and two or three possible sites have been considered. Eventually the necessity for providing adequate accommodation for the greatly-increased staff made the matter urgent, and a decision was taken to acquire and proceed with the reconstruction of premises in Harmer Street. This is just off the main road, which is the next best thing to being actually in the principal thoroughfare. The premises permitted of the construction of a double-fronted showroom of adequate depth and gave ample accommodation to the staff, the repairs department, and a caretaker. As will be seen from the accompanying view of the premises (fig. 1), the windows gave an unobstructed view of the whole of the interior. In the left-hand window are arranged examples of the cookers which the Department supplies on hire-purchase, while on the walls are straightforward announcements of the facilities which the consumer has at his disposal. The right-hand side is recessed to form a bathroom, complete with a bath over which a "Sadia" 11-gal. water heater is fitted, a hand basin, and an electrically-heated towel rail, which is of sufficient size to act as a heater as well. In the window there appear a "B.T.-H." refrigerator, suitable for a shop or restaurant, more "Jackson" cookers, and a "Magicoal" fire. It will be observed that attention is practically confined to the appliances employed in the hire-purchase scheme. The heating of the showroom is carried out by means of "Unity" tubular

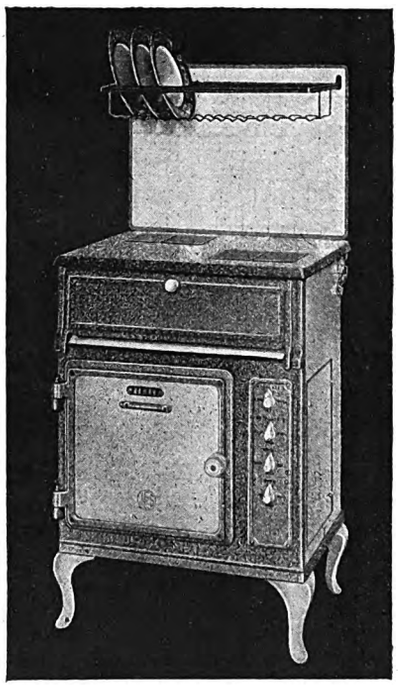

Fig. 2.—The Jackson "No. 56" Cooker.

heaters arranged near the floor level. This system is also used in the well-appointed offices on the upper floors, and "Magicoal" fires are also in evidence.

The showroom and offices were opened by the Mayor of Gravesend (Councillor R. McGregor) on Wednesday last week. His Worship made brief reference to the progress of the undertaking, and the chairman of the Electricity Committee (Councillor J. W. Clunn) made a more detailed statement. The latter said that the Department was run on business-like lines, but it sought to establish personal relationships with its consumers. Mains were laid wherever there was a prospect of a reasonable return, and now they had over 5,000 consumers. About 400 cookers had been disposed of and applications were being received at a good rate. In previous years the undertaking had relieved the rates considerably; now, however, its assessment had been raised so much that they could not continue this practice. Instead they proposed to build up a strong reserve from which developments could be financed. The net profit for the year ended

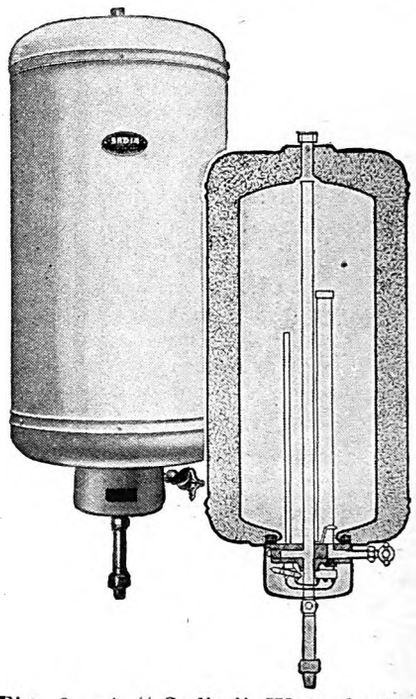

Fig. 3.—A "Sadia" Water-heater.

March 31st last was £17,231. The Department maintained good relationships with the local contractors. It only supplied cookers, water-heaters, and wash-boilers, and left the wiring and supply of other appliances to the contractors. The vice-chairman of the Committee (Councillor W. H. B. McKenzie) said that the people had reason to be proud of the success of the electricity undertaking of which it was the owner. After the ceremony tea was served, made from soft water obtained from the greensand artesian well at the works. (Gravesend's water supply is very chalky.) Cakes and pastries cooked electrically played their part in impressing the visitors with the virtues of electricity.

From the date of the opening for a fortnight, electric cooking has been demonstrated by a lady from the Jackson Electric Stove Co., Ltd.; considerable interest has been shown by the public, and a large influx of new business should result.

A Thermal-storage Cooker.

The following particulars concerning a thermal-storage cooker of the iron-block type used in Sweden were given in a lecture by Mrs. Dover, B.Sc., before the Electrical Association for Women, and are taken from a recent issue of *The Electrical Age*. The great drawback hitherto in electric cooking has been the time required to obtain the initial heat. This has now been overcome. A cooker has been constructed in which a *hot* hot-plate is always available. Besides this great asset there is an oven at the necessary temperature for simmering, connected to the hot-plate by a mechanical heat-transferring device, in which food can be put to cook slowly without requiring any further attention. This new part of the thermal-storage cooker can be plugged into any outlet of the ordinary lighting installation. Used with it is a baking oven for roasts, cakes and pastry, which can also be plugged into any outlet. The circular iron disk under the dome-shaped lid is the top of an iron block and forms the hot-plate. The iron block contains two heating elements which are supplied with electricity so as to produce an average temperature of 900 deg. F. The elements are thermostatically controlled. It has been found by experiment that the temperature of the oven—190 to 200 deg. F.—is the most suitable temperature for cooking food in the most nourishing way.

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The Berlin Wireless Exhibition.

Some Useful Figures from a Highly-competitive Industry.

(COMMUNICATED.)

THE number of exhibitors at the annual German Wireless Exhibition held early in September was approximately four hundred, and the exhibits filled the three large exhibition halls in the permanent exhibition grounds in the Kaiserdamm quarter

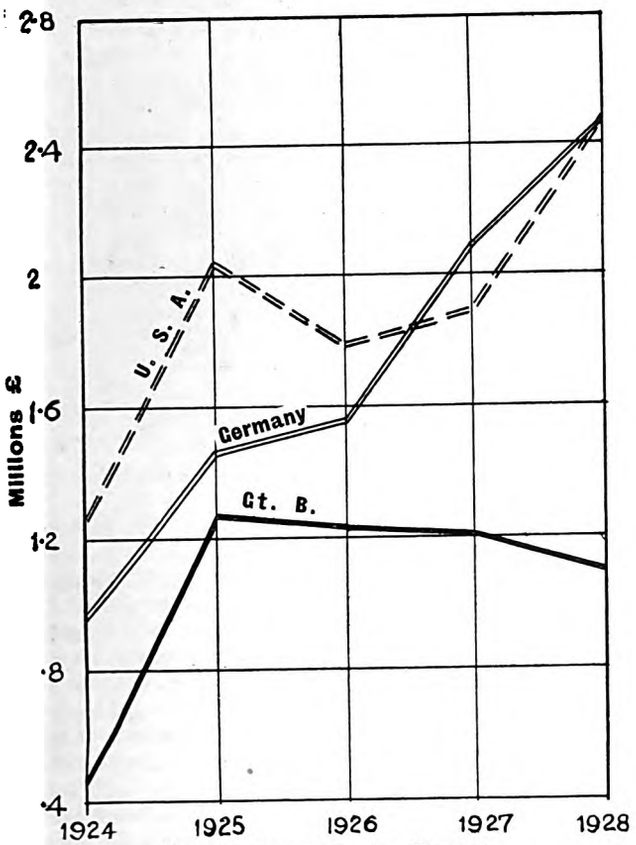

Fig. 1.—Total Radio Exports.

of Berlin. Of a gathering of such size it is only possible to record general impressions, and for the purpose of a brief survey of the state of the German industry the most useful basis is an examination of the figures and statistics with which most German organisations are so well provided.

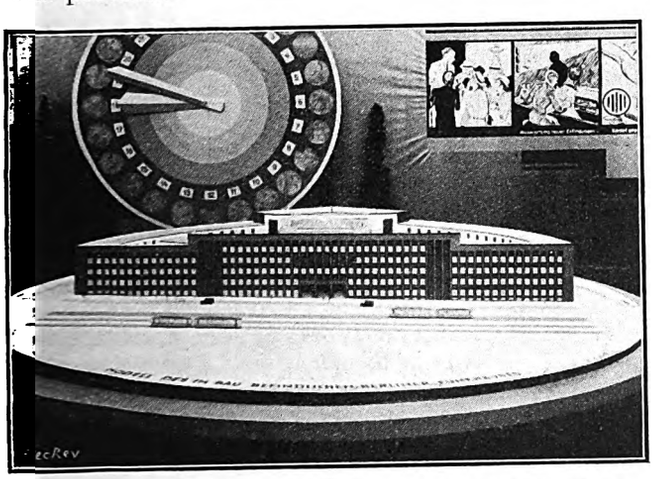

Fig. 2.—Model of Broadcasting Organisation Headquarters in Berlin in course of Construction.

The General Position.—Regarded from the international aspect, it is evident that Germany is destined to take the position of leading exporting country, so far as wireless goods are concerned, the position in this respect being outlined by the following chart 1 and Table I showing the relative shares of the wireless export trade taken by Germany, the United States, and Great Britain.

TABLE I.—TOTAL RADIO EXPORTS.

	1924. £	1925. £	1926. £	1927. £	1928. £
Germany	960,850	1,478,300	1,581,800	2,099,000	2,467,000
U.S.A.	1,243,487	2,042,018	1,813,300	1,906,000	2,486,883
Gt. Britain	465,292	1,289,749	1,266,384	1,203,856	1,109,555

Some few years ago German competition was a very serious feature of the wireless trade in this country, but, although Great Britain still remains the largest importer of German wireless goods in the world, it is

TABLE II.—AMERICAN AND GERMAN EXPORTS TO GREAT BRITAIN.

	1924. £	1925. £	1926. £	1927. £	1928. £
Germany	441,550	388,950	215,500	246,800	214,160
U.S.A.	29,338	132,972	95,150	54,741	94,846

very evident that such imports are becoming gradually less each year as British makers' prices drop gradually to Continental levels. In this connection, it is interesting to compare the respective shares of the British home market taken by the United States and Germany. The exact figures relating to this trade are as indicated in Table II and the second chart, fig. 3.

Receiving Sets.—An outstanding feature of the Berlin exhibition this year was the great display of all-mains sets, but the deductions drawn by most visitors from this display are often fallacious. A great attempt has been made during the past few years to popularise such sets, but the fact is that they are not so widely used as the visitor would imagine. Some valuable figures in this connection are available from

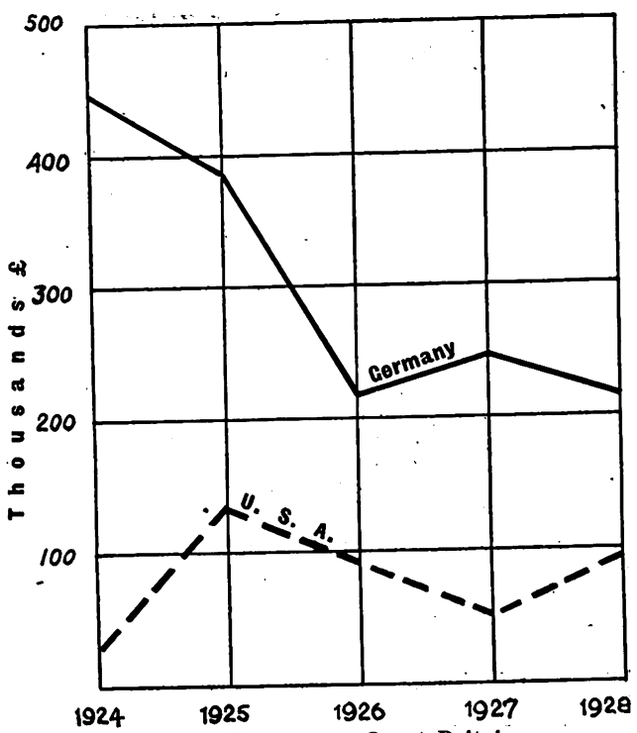

Fig. 3.—Exports to Great Britain.

the records of the manufacturers' association acting as an intermediary between the makers of receiving sets and the company holding the main body of wireless patents in Germany. If valve receivers are divided

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into two broad classes, *viz.*, battery-operated and mains sets, the proportions of sets manufactured during 1928 were 94.5 per cent. of the former class and 4.5 per cent. of the latter, so that it is very evident that the older type of battery-operated set has still a very large field of usefulness.

Information upon the class of receiving sets in most general demand is of considerable use to both manufacturers and traders. German receivers can also be classified in two groups, known in that country as "local station" sets (det. and l.f. valves) and "distance" sets (h.f., d, and l.f.). During 1928 the total number of instruments of these two classes were, respectively, 507,000 and 142,000. In the local-station class the most popular instrument was the 3-valve set, of

Fig. 4.—Typical Stand of a Large German Manufacturer.

which 305,000 were manufactured, and in the "distance" class the 4-valve set was in greatest demand, the number manufactured being 60,000.

The production of valve receiving sets increased in a marked manner during 1928; taking as a basis for comparison the total number of valve holders incorporated in the sets manufactured, the figures in Table III. will show that the production of receivers is a very important branch of the industry. This considerable trade is shared amongst the 104 manufacturers of receivers who are members of the association.

Table III.—Valve Holders.

Year	1924.	1925.	1926.	1927.	1928.
Valve holders in sets made	97,000	208,000	233,000	567,000	1,537,000

Loud Speakers.—Turning to the loud-speaker section of the industry, the number of manufacturers is just under one hundred. Owing to the growth in popularity of the cone-type of speaker during the past few years and the existence of a group of basic patents protecting this type of speaker, the majority of the makers in this group are also members of an association operating upon similar lines to the receiver association, so far as licensing and the collection of royalties are concerned. The total sales value of loud-speakers of the manufacturers in this association has been returned as £500,000 during 1928. This figure, however, does not represent the total value of the German loud-speaker trade, as there is a number of fairly important makers owning rival patents who are still outside the main group, and of whose total trade no particulars are available.

One of the results of the immense number of loud-speaker exhibits has been the tightening up of the regulations respecting their use during the period of the exhibition. In previous reports mention has been made of the fact that demonstrations were given of both receiving sets and loud-speakers. This year, for the benefit of the public, the regulations confined the use of loud-speakers to instruments of normal size, which, in addition, had to be demonstrated solely in the sound-proof cabinets provided behind the main stands. A very noteworthy feature of this trade this year was the influx of makers into the dynamic speaker field.

Résumé.—The German wireless industry now appears to be fairly stable, judging by the fact that the greater portion of the exhibitors have been regularly represented at the exhibition every year, and the sudden disappearance of well-known names is not so noticeable as it was during the first year or two of the trade. It is doubtful, however, whether any considerable profit is to be made in this industry, as the competition is such that a manufacturer who wishes to do any large trade is practically obliged to produce a series of popular models to sell retail at a price in the neighbourhood of £2 for a 3-valve receiver. In the case of the more elaborate multi-valve sets, the general appearance of which strongly resembles that of American models, prices are naturally higher, but even so they are very noticeably lower than American prices. Though intense competition has contributed largely to this low level of prices, the lower scale of patent royalties in force is also a contributing factor which cannot be ignored when considering this aspect of the subject.

Transoceanic Radio-telephony.

Brief details of the recently inaugurated wireless link between Spain and South America.

(COMMUNICATED.)

THE last few years have been notable for the large extension of telephone facilities throughout the world, particularly in the case of international telephony, and we are fast progressing towards the time when any person possessing a telephone will be able to speak to any other telephone subscriber in the world. In January, 1927, the transatlantic radio circuit linked not only the two great English-speaking nations of Great Britain and U.S.A., but also the continents of Europe and North America. A very important further advance was made on October 12th, when General Primo de Rivera, speaking from Sevilla, declared open the International Telephone and Telegraph Corporation's radio-telephone link between Madrid and Buenos Aires. For the first time the telephone systems of Europe and South America were connected, and the Spanish-speaking Republics of Latin America linked with their mother country by means of a transoceanic circuit.

The new service is a link in the truest sense of the word; that is to say, it does not merely give a service between special booths in the capital cities of the countries which it joins, but it is arranged for connection to the local telephone networks at each of its terminals, and acts precisely as though it were a wire line. Calls are dealt with in the same manner as ordinary toll connections, and there is nothing to indicate to either the caller, or the person to whom the call is addressed, that a radio link is included in the circuit.

The telephone systems served by the link are very extensive. At the South American end connection is made to 210,000 telephones in the Argentine Republic, 17,000 in Uruguay, and 30,000 in Chile. At the Europeon end there are 155,000 telephones in Spain to which the service is available, and there are no technical difficulties

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The Hairdressing Fair.

Some comments and descriptive details of the electrical exhibits displayed at the annual show in London.

ORGANISED by the Hairdressers' General Committee and the Hairdressers' Wholesalers' Association, Ltd., this season's annual Fair at the White City, London (October 19th to 26th), proved to be one of the most successful displays that the trade has ever presented.

Fig. 1.—A Barber's Pole.

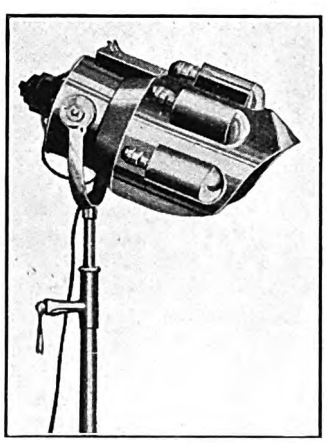

Fig. 2.—A Hair Dryer.

Fig. 3.—The "Air Evos" Distributor.

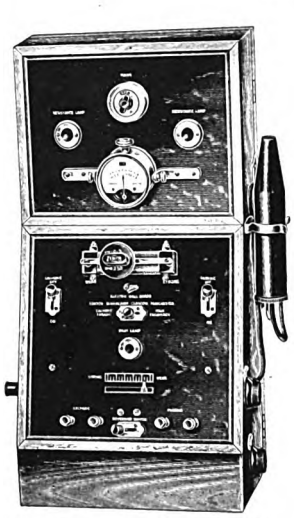

Fig. 4.—The "Ogee" Switchboard.

The show prominently emphasised the extent to which mechanical and electrical "tools" are employed by the up-to-date hairdresser, and if all trade exhibitions were as completely electrical in character as the one we are dealing with appeared to be, there would be little cause for fault-finding. On the 22 stands, out of the total of 80, on which mechanical or heat-producing aids were exhibited or in use, practically all of them were electrically operated, only two devices in the whole show being noticed which were gas-heated.

OSBORNE, GARRETT & CO., LTD., displayed on one of the largest stands, amongst numerous electrical apparatus, the symbolic sign of service (fig 1). It is an electrically-driven revolving barber's pole, the glass cylinder being illuminated in colours. As its name implies, the "Fasdry" is a time-saving head dryer. Its total loading is 1,500 watts; it consists of a metal hood (fig. 2) into which the head is placed, and is provided with a fan, electric heater, and five small tubular lamps that dry all parts of the head simultaneously. Fig. 3 is another of the varied types of blower utilised; it is known as the "Air Evos" distributor for facilitating the setting of permanent waves. Fig. 5 shows the new "Pilot" curling-iron stove, mounted on a wall bracket; it is fitted with a 3-heat switch (total load 175 watts) and a ruby pilot lamp in the base. Vacuum cleaners are very useful in a barber's shop for collecting hair clippings much more effectively than by sweeping. The company's model is of 200 watts size. Vibrators (fig. 13) and switchboards (fig. 4) for the application of galvanic, faradic, electrolysis, and high-frequency treatments from the mains were also in evidence.

I. CALVETE, LTD., showed amongst a variety of electrical devices the "Solart" arc lamp (fig. 7) for the ultra-violet radiation of the hair; it works on a.c. or d.c., 50 to 250 V, and 4 A. The "Champion" dryer is illustrated in fig. 11, while one type of massage vibrator is shown in fig. 12, and fig. 10 depicts a high-frequency and violet-ray outfit.

WALDEN, WALDEN & CO. exhibited a labour-saving tool in the form of an electric hair-clipper (fig. 6), which is quite easy to use, being of light weight and convenient size to hold in the hand. It weighs 1.5 lb., including cable and plug, and can be used on a.c. and d.c. at 110, 150, and 220 volts.

MARCHANT, HILLS & CO. also showed an electric clipper (fig. 8) that is characterised by its simplicity of construction; it is known as the "Wahl," while a somewhat similar machine is the "Hand-e" electric massage vibrator, both of which are noiseless in operation, light, and powerful.

On CALMAN & NEATE'S stand a well-made massage roller was noticed; it is electrically-heated and fig. 9 indicates the method of using it.

C. NESTLE & CO., LTD., besides blowers, "Sun-aero" dryers, &c., demonstrated electrically-heated permanent hair waving apparatus as illustrated in fig. 14. It consists of a number of small electric heaters, each enclosed in a cylinder of moulded material and suspended from a flexible conductor. After the application of certain liquid solutions, small portions of the hair are rolled up tightly and placed inside the heaters, thereby being steam dried into a wave formation.

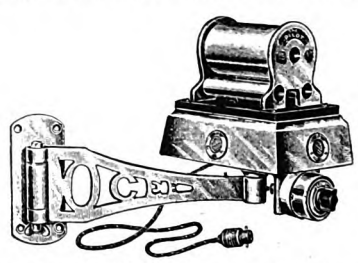

Fig. 5.—A Curling Iron Heater.

Fig. 6.—The "Forfex" Hair Cutter.

Fig. 7.—Arc Lamp.

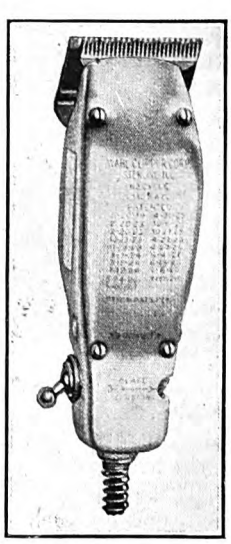

Fig. 8.—The "Wahl" Clipper.

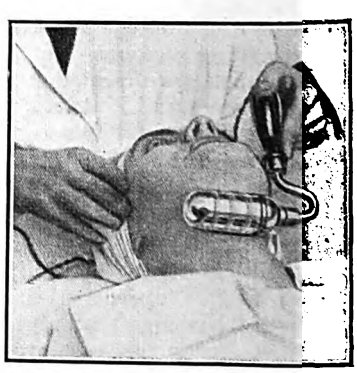

Fig. 9.—A Massage Roller.

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Health Devices, Ltd., electric motor vibrators.
N. Stecklyn & Sons, blowers and saloon equipment.
Hubert's, Ltd., permanent wavers.
Eugene, Ltd., hair wavers.
Dexter Manufacturing Co., a variety of blowers, vibrators, high-frequency devices, therapeutic lamps, &c.
Jarvis & Co., central hair-drying equipment and other electrical apparatus.
Drake & Gorham, Ltd., automatic "Duro" water softeners.
Quintons demonstrated the "Steamol" permanent waving machine.

Fig. 10.—High-frequency Outfit.

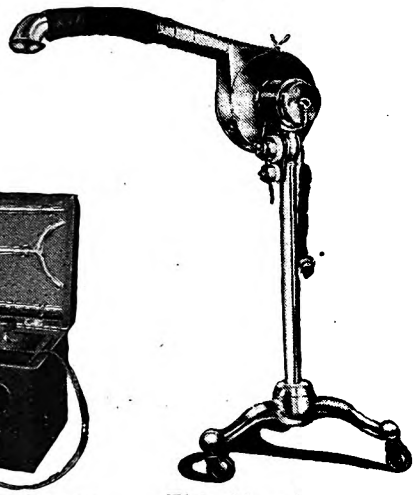

Fig. 11.—A Pedestal Blower.

Bedington, Liddiatt & Co., Ltd., motor-driven "Savage" exerciser and reducer.
Nageles (London) electrical dryers and other appliances.
M. Calderon, general electrical apparatus for hair-dressing saloons.
British & Foreign Machinery Co., permanent waving machines, time switches and current indicators.
W. Bredt, violet-ray and h.f. outfits, "Cuproflex" electrically-illuminated non-dazzle shaving mirrors.
Electrolux, Ltd., vacuum cleaners and water softeners.
Institute of Trichologists, Inc., electrical apparatus as applied to trichology.

The above brief survey will suffice to indicate that barbers are making a by no means inconsiderable use of electricity in their trade. Whilst its chief applications are for heating and drying, small power devices also suggest themselves, and there would seem to be opportunities for contractors to do business with many of the 25,000 hairdressing establishments that are said to exist in the United Kingdom. From October to April the hairdresser's lighting bill is at its heaviest. All except after-hour window lighting represents indispensable consumption, and the cost per kWh, ranking as an overhead charge to be deducted from the saloon profit, is the same whether the equipment installed is good or indifferent. The very nature of the trade necessitates illumination above the average; the fashion of covering the walls with large mirrors makes precautions against glare very desirable; and annoying shadows must be eliminated. It is worth some little effort, therefore, to discover what is the best practice for each individual lighting point, and the contractor or dealer who is able to offer the correct illumination advice should find it worth his while to do so.

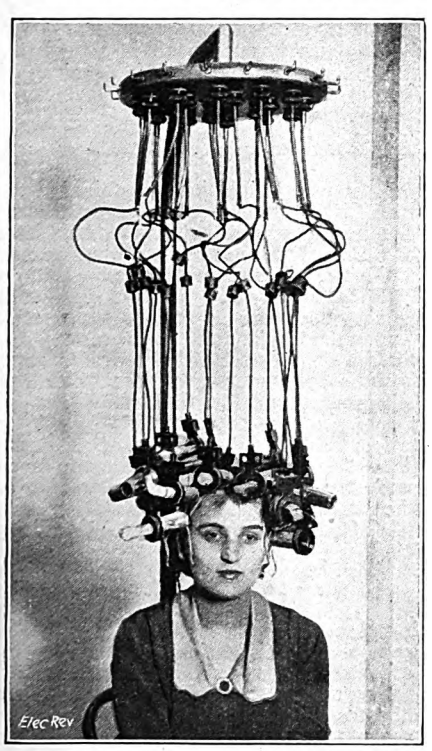

Fig. 14.—Permanent Waving Apparatus.

Fig. 12.—"Icall" Massage Vibrator.

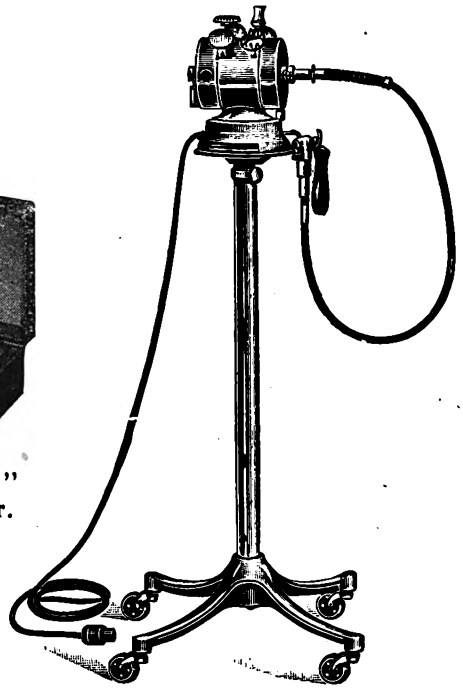

Fig. 13.—Motor-driven Vibrator.

Legal.

Dorman, Loug & Co., Ltd., Fined.

Messrs. Dorman, Long & Co., Ltd., were fined £5 and costs at the Middlesbrough Police Court on October 23rd for a breach of the Factory and Workshops Act.

Mr. Harding, Inspector of Factories, said that the company employed a man named Porter at the Britannia Iron Works, Middlesbrough, and on August 10th last he was killed by an electric shock while at work on the track of a gantry crane. It was alleged that he touched a wire which was only nine inches from where he was working.

Mr. Reuben Cohen, for the defendants, said that the company appointed a special committee to trace the cause of such accidents, and acting on its recommendations the company was raising the wire out of the reach of the workmen.

Oxford Corporation v. Oxford Electric Co., Ltd.

In the Chancery Division last week, Mr. Tyldesley Jones, K.C., asked Mr. Justice Romer to fix a day for the hearing of this action. He said it was in Mr. Justice Maugham's list, but for personal reasons he could not hear it. He asked that it be fixed for November 12th. It was a case in which questions arose on the construction of a purchase clause, and there was a counter-claim on which expert evidence would have to be called.

His Lordship said he would have it put into the list for hearing on November 12th, subject to anything part heard.

Japanese Customs Regulations.

The following are among recent decisions of the Japanese Customs authorities:—Steam turbine generators, consisting of steam turbines and generators, each having a separate shaft and capable of disconnection, are dutiable separately, the turbine under Tariff No. 575—import duty 20 per cent. *ad valorem*, and the generator under Tariff No. 579 (dynamos weighing more than 5,000 kg.)—at specific duties varying according to the weight of the generator. Water-turbine generators, consisting of water turbines and generators, each having a separate shaft and capable of disconnection, are dutiable separately, the water turbine under Tariff No. 578 and the generator under Tariff No. 579, at rates varying according to the weight of the plant.—*Board of Trade Journal.*

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Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

Mr. Snowden on Taxation and Rationalisation.

Speaking at the annual Cutlers' Feast at Sheffield on October 24th, Mr. Philip Snowden, Chancellor of the Exchequer, said that although the revenue had come in fairly well during the past seven months the rate would have to be greater during the remainder of the period if the Budget estimates were to be justified. He could not hold out much hope of reduced taxation when he presented the next Budget as the obligations to be met were very heavy. If taxation was increased it would be from sheer necessity and not on account of any desire to impose new taxes. It was not generally realised how heavy the burden of war taxation was. The war debt and pensions and the cost of the fighting services absorbed five-sixths of the amount raised by taxation. With regard to unemployment, he said that there was a danger that industrial leaders would rely too much upon Government assistance. The only permanent solution of the problem was to encourage the development of those industries which were engaged in work of a permanently-recurring character. There was overwhelming evidence that British would-be importers were not so strenuous in their efforts in overseas markets as their foreign competitors. The salvation of British manufacturing industries lay in rationalisation. Although it had been argued that rationalisation meant the displacement of labour, he was convinced that the improved efficiency which would result would substantially increase export business and vastly increase the capacity of industry for employment. He concluded by stating that he hoped to announce in a few days the constitution of the committee which he was appointing to inquire into the related questions of finance, banking and credit.

Empire Trade.

We have received a copy of a penny pamphlet entitled "Empire Free Trade: The New Policy for Prosperity," by Lord Beaverbrook (*Daily Express*). It consists of a manifesto in favour of Imperial Free Trade. Summarised, its policy is:—(1) The Empire is to be regarded as a single economic group, and trade between the various parts, subject to qualifications stated in the pamphlet, is to suffer no restrictions. (2) The interests of this group are to be conserved by a tariff wall against the rest of the world. (3) Within this group, the economic interests of the parts are to be strengthened by a policy of agreements, quotas and compensations.

Wages in the Contracting Industry.

A 5 per cent. increase in wages was granted on May 1st to employés of electrical contractors in the London District for a period of six months; this period terminated with the last pay-day in October, for the period covered by that pay-day. The National Federated Electrical Association informs us that it has been agreed to continue the increase, pending further negotiations, and the current rate (1s. 10½d.) will therefore remain in operation for the present. This decision also affects the wages of plumber-jointers and their mates (electric cable-making industry) in the London area

Electrical Christmas Gifts.

Few of our readers will quarrel with our contention that electrical men should give electrical Christmas presents, and even the lay public cannot find a better and wider selection in any other direction. We are moved to these remarks by the receipt of some notes upon the subject from the GENERAL ELECTRIC CO., LTD. These draw attention to the variety of electrical appliances and fittings available for presentation at Christmas, and many examples are illustrated. The pictures include electric fires, cookers, lighting fittings, radio apparatus, and a number of handy table appliances.

Regulations for Chinese Electrical Undertakings.

It is reported from Shanghai that protection and supervision by the Government of all electrical enterprises operated by private commercial concerns has been decided upon. It has also been resolved that in drafting the regulations governing the supervision of such enterprises, emphasis should be laid upon the responsibility to, and welfare of, the public. Local authorities are not to interfere with the internal administration of such enterprises, nor must they levy any tax thereon without the sanction of the Executive Yuan. In the event of any such concern being taken over, the Provincial or municipal authorities concerned will have first to secure the approval of the Executive Yuan.

Patent Application.

Application has been made for the restoration of Patent No. 245,252 of 1924, granted to M. Wilderman for "Improvement in and in connection with diaphragms to be used in electric batteries."

Polish Foreign Electrical Trade.

During August last "apparatus, conductors and other electro-technical materials" valued at 6,555,000 zloty (£152,000) were imported into Poland. Polish exports of the same class had a value of 100,000 zloty (£2,300).

A return just to hand shows that the value of the electrical machinery imported into Poland during the six months ended with June last amounted to £358,620, as compared with £314,945 in the first half of 1928. There was also an increase during the same period in the imports of electrical goods and fittings—from £935,630 to £1,080,460.

A Novel Rebate Scheme.

Messrs. WILLIAM SANDERS & CO., LTD., Wednesbury, have sent us particulars of a scheme which they have evolved by which regular buyers of their switchgear will receive a rebate according to the amount of their purchases. To every article they intend to attach a yellow tag bearing the list price. These tags will be retained until their total value, after the deduction of the trade discount, reaches £50 or more. When they are returned to the company a voucher will be issued to the sender which will entitle him to credit from his usual supplier (or, if business is done directly, a credit note will be issued by the company) on a rising scale.

The Manchester Smoke Abatement Exhibition.

A Smoke Abatement Exhibition organised by the *Daily Dispatch*, at the City Hall, Deansgate, Manchester, is to be opened by the Minister of Health (Mr. Arthur Greenwood) on November 5th. One of the most interesting sections will be the exhibit of the British Electrical Development Association, in which all that electricity can do in industry and in the home is to be demonstrated. It will be supported by supply undertakings, manufacturers and contractors. A committee fully representative of the Association and all branches of the industry, under the chairmanship of Mr. L. Romero, Salford city electrical engineer, and Mr. R. C. Hawkins, of the Association, is in charge of the detail work. The "Outlet Campaign" will be represented in the exhibition. A number of shop windows will be "featured," and on the industrial side the Association will stress the virtues of electricity as a means of supplying hot water in bulk, and for works' canteen equipment. The use of electricity in commercial baking is also to be demonstrated.

The Wakefield Financial Loss.

At a meeting of the Wakefield City Council last week it was resolved to promote a Bill to authorise the borrowing of a sum sufficient to cover the loss sustained in respect of a loan issued for the Council by a company of the "Hatry" group.

The *Yorkshire Evening Post* reports that the Council had an alternative suggested to it, that was the sale of its electricity undertaking to the Yorkshire Electric Power Co. Ald. G. H. Sherwood, M.P., to whom the offer was communicated originally, said that if the circumstances had not been so tragic it would have appealed to his sense of humour that he, of all men, should be asked to take part in a proposal that the city should dispose of one of its most valuable assets. Mr. W. B. Woodhouse, the company's engineer and manager, replied that the real asset to the city was a cheap supply of electricity, and under the company's proposal the price of electricity would be reduced. In any event the city would eventually be supplied by the company's Ferrybridge station under the Central Board's scheme.

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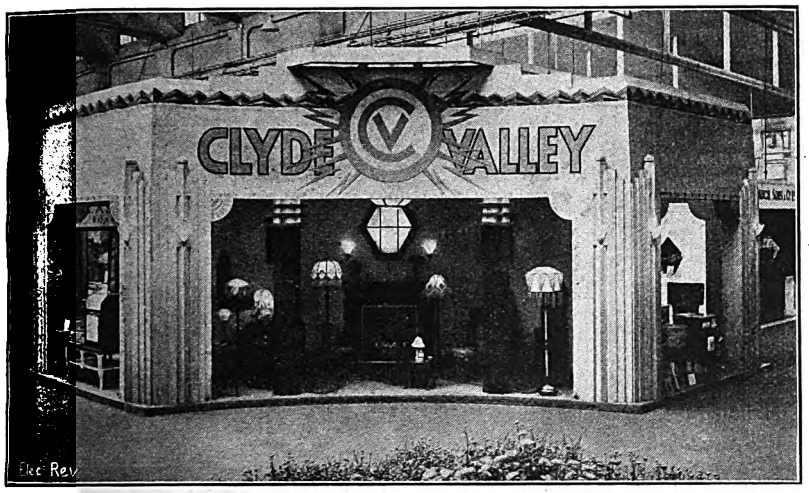
Unemployment.

There was a further rise of 7,764 in the number of persons on the registers of Employment Exchanges in Great Britain during the week ended October 14th. At that date the total was 1,215,000, as compared with 1,207,236 on October 7th, and 1,321,154 on October 15th, 1928.

A Clyde Valley Exhibit.

At the Glasgow Corporation Housing and Health Exhibition, which was held at the Kelvin Hall recently, the display of the Clyde Valley Electrical Power Co. attracted considerable attention. It included, in addition to a comprehensive range of domestic appliances, an all-electric kitchen, lounge, and fire showroom. The accompanying illustration conveys an impression of the company's excellent display.



The Lounge on the Clyde Valley Company's Stand.

Trade Announcements.

NORTHANTS ELECTRICAL INSTALLATIONS, LTD., is having its premises in Cowgate, Peterborough, reconstructed and extended. In the meantime the business will be conducted at 21, Cumbergate.

Messrs. S. W. WALKER & SON, radio engineers, Winchester, have opened an additional establishment at 21b, Southgate Street, in that city.

Messrs. J. R. MORRIS, Imperial House, Kingsway, W.C.2, have appointed Mr. H. H. PATRICK, 246a, Corporation Street, Birmingham, as their representative in the Midland Counties for the sale of "Columbia" radio batteries, flashlights, &c.

Messrs. TURNER BROS. ASBESTOS CO., LTD., announce that the sale of "Sindanyo" insulating board has been taken over by a new associated company, TURNER'S ASBESTOS CEMENT, LTD., Trafford Park, Manchester.

Mr. H. LITTLEWOOD has commenced business as an electrician at 18, Scholes Road, Birkby, Huddersfield.

Owing to increased business, Mr. GEORGE P. COSWAY ("Dred-Nort" link disconnecting box) has taken larger works in Anker Street, Nuneaton; his postal address will remain the same.

Messrs. CRAMP & CRESSWELL have opened an electrical business in Blackburn Road, Accrington.

Catalogues Wanted.

The HENDON LAMP & ACCESSORIES CO., LTD., 104, Southampton Row, W.C.1, asks for lists from manufacturers of electric heating and cooking apparatus, electrical accessories, &c.

Australian Babcock & Wilcox Branch Reorganised.

The *Industrial Australian and Mining Standard* states that the Australian branch of Babcock & Wilcox, Ltd., is being reorganised and strengthened. An Australian board of directors has been established, and Sir Henry Braddon and Sir John Butters have become Australian directors. The Australian directors will have full power and authority to deal with all questions of the policy and work of the company in the Commonwealth. Mr. A. J. Arnot, general manager, has expressed his wish to retire. Mr. H. W. Morgan, assistant general manager, has been appointed general manager. The new organisation became effective on October 1st. Engineer Vice-Admiral Sir Robert Dixon, a member of the London board of directors, and, until June, 1928, Engineer-in-Chief of the Royal Navy, is now in Australia to bring the new arrangements into effect. The company established a large works at Regent's Park, near Sydney, in 1923, and, when working at full pressure, this gives employment to more than 600 men.

Bulgarian Electrical Progress.

The Sofia correspondent of the Federation of British Industries reports that the building and equipment of small electric power stations all over Bulgaria is making remarkable progress. There are already 110 local stations in operation, supplying electricity to a population of about 1,000,000. Last year, a consumption of 23,000,000 kWh was recorded for lighting purposes, and 29,000,000 kWh was used for industrial needs. The movement is expected to gain more and more ground in the near future, and there appear to be interesting prospects for doing business in this connection. The chief supplying countries are at present Germany, France, Czecho-Slovakia, Austria and Hungary.

Recent Contracts.

Three of the largest mining companies in Australia, operating in the Broken Hill district, recently decided to effect economies by co-ordinating their respective power plants in one station. This new power station will supply the whole of the electricity and compressed air requirements of the three companies, namely, North Broken Hill, Ltd., Broken Hill South, Ltd., and the Zinc Corporation, Ltd. It has been decided to install Diesel oil engines for the prime movers, and, as we mentioned in our last issue, orders have been placed with Messrs. MIRRLEES, BICKERTON & DAY, LTD., for four 1,230-b.h.p. "Mirrlees-Diesel" engines, the value being approximately £50,000. Each engine will drive a Belliss & Morcom air compressor. The generating sets have been ordered from Messrs. Sulzers, and will consist of six 3,000-b.h.p. Diesel engines, each driving alternators manufactured by the BRITISH THOMSON-HOUSTON CO., LTD., Rugby. The Australian General Electric Co. is the main contractor for the supply of the Diesel compressing sets, switchgear and electrical accessories. The cost of the project will total about half a million pounds sterling, and, when completed, the station will be one of the largest Diesel oil engine power stations in the world. Mr. F. J. Mars, of Melbourne, has been responsible for the development of the scheme.

It is reported that the contract for the supply and erection of the constructional steelwork for the first section of the new Battersea power station has been placed by the London Power Co., Ltd., with SIR WILLIAM ARROL & CO., LTD.

New Catalogues and Lists.

MORSE CHAIN CO., LTD., Letchworth, Herts.—Handbook No. ML929, dealing with standardised and individually suitable Morse chain drives ranging from 1 h.p. to 60 h.p. and containing information relating to installation, maintenance, chain cases, &c. Illustrated.

Z ELECTRIC LAMP & SUPPLIES CO., LTD., 73, Newman Street, Oxford Street, W.1.—Price lists of lamps and valves. The lamp list also contains a useful discount chart and ready reckoner.

IGRANIC ELECTRIC CO., LTD., 149, Queen Victoria Street, E.C.4.—A number of publications drawing attention to the company's radio components, including "Springmore" plugs, l.t. supply unit, battery charger, input transformer and short wave h.f. choke.

Mr. CUTHBERT ANDREWS, 47, Red Lion Street, High Holborn, W.C.1.—Two pamphlets describing the "Protexray" hot-cathode tube.

BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—Several price and descriptive lists of a.c. starting rheostats, ironclad, oil-immersed thermal circuit-breakers, squirrel-cage induction motors, filters, auto-transformer starting equipments, air cooling systems and rotary convertors; also an index of the company's current publications covering electrical machinery, switch and control gear.

Mr. ALAN WRIGHT, 117, Victoria Street, S.W.1.—A leaflet advertising the "Inventum" bed warmer.

Messrs. CHARLES JOYNER & CO., LTD., Icknield Square, Birmingham.—List No. F.106 giving illustrated particulars of "Angelus" electric fires. Priced.

GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—The Osram G.E.C. Bulletin for October contains in addition to notes on the company's products, interesting articles on the lighting of the Commodore Theatre, Blackpool autumn illuminations, and the resumption of shop window lighting.

KORTING & MATHIESEN ELECTRICAL, LTD., 711 and 715, Fulham Road, S.W.6.—The October issue of the Kandem Quarterly Review includes illustrated articles on the lighting of schools and hospitals.

Messrs. L. G. HAWKINS & CO., LTD., 30/35, Drury Lane, Kingsway, W.C.2.—A comprehensive pocket catalogue (pp. 206) of the company's products, fully illustrated and priced. An alphabetical index is provided and the publication is bound in a strong cover.

CANTIE SWITCHES, LTD., Leighton Works, Carlton Road, Nottingham.—A leaflet drawing attention to "Cantie" switches, with particular reference to their application to woodworking machines.

HIGGS MOTORS, Witton, Birmingham.—An October stock list of a.c. and d.c. motors.

Mr. J. B. RUDKIN, Albion House, 59, New Oxford Street, W.C.1.—An illustrated and priced catalogue dealing with outdoor switchgear for rural distribution.

PRIVATE TELEPHONE & ELECTRIC CO., LTD., 28, Great Queen Street, Kingsway, W.C.2.—Three illustrated booklets drawing attention to the company's intercommunication telephones, telephones for private houses and small offices, and electric

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bell indicators and pushes and telephone switchboards for hotels.

Brown Brothers, Ltd., Brown's Buildings, Great Eastern Street, E.C.2.—Illustrated catalogue No. 291 (pp. 192) covering a comprehensive range of appliances, fittings and accessories. Each section is arranged alphabetically and an index facilitates reference to a particular product. Retail prices are given, and the trade prices are concealed in a simple code. The catalogue is bound in stout cardboard.

Hendon Lamp & Accessories Co., Ltd., 104, Southampton Row, W.C.1.—Two price lists of "Popular" and "Hendon" lamps. The company overprints these lists with the name and address of any electrical trader.

Midland Electric Manufacturing Co., Ltd., Barford Street, Birmingham.—List No. 180, containing illustrations, dimensions and prices of switch and fuse-gear. Useful notes on the selection and maintenance of switches and fuses and short-circuit values are also included, together with a number of wiring tables.

International Electric Co., Ltd., 20/21, Essex Street, Strand, W.C.2.—A carton for packing "I Echo" wireless cords.

Art Metal Construction Co., 199/203, Buckingham Palace Road, S.W.—A folder advertising art metal adaptable office files.

New Showrooms at Fleet.

Another definite step marking the progressive policy of the Aldershot Gas, Water and District Lighting Co., was made on October 17th, when an imposing new gas and electricity showroom was opened by Mrs. R. W. Edwards, wife of the company's chairman and managing director. The showroom has been built to cater for the needs of the company's large western area which, in addition to Fleet, includes Hartley Wintney, Odiham, Crookham, Crondall and a number of smaller villages. The general lighting of the showroom has been carried out by the company's own staff to the design of the General Electric Co., Ltd., the main illumination being by means of concealed bracket lights of very artistic and pleasing design. The show-windows are flood-lighted and several colour effects can be obtained. In addition to the primary illumination, points have been provided from which an attractive variety of modern lighting fittings are displayed. Every type of electrical domestic apparatus is on view and individual bays are equipped to represent an electric kitchen and a bathroom. The accompanying illustrations give an indication of the external attractiveness of the building and also of the very tasteful manner in which the interior has been furnished. The design of the premises was outlined by Mr. A. D. Barraclough, the company's chief engineer, and elaborated by Mr. J. Love, L.R.I.B.A.

The New Showrooms of the Aldershot Gas, Water and District Lighting Co.

The 20th Illumination Design Course.

We are informed that the number of "students" who attended the first lecture of the 20th Illumination Design Course at the London Lighting Service Bureau was 103. This indicates that interest in these useful courses is being well maintained.

Book Notices.

"Telegraphy and Telephony, including Wireless Communication," by E. Mallett. Pp. ix+413; figs. 287. London: Chapman & Hall, Ltd. Price 21s. net.

"Questions and Solutions on Magnetism and Electricity." Solutions by W. J. White. 3rd edition. Pp. vii+178, figs. 97. London: Sir Isaac Pitman & Sons, Ltd. Price 5s. net.

"Wireless Transmission and Reception." Technical pamphlets for workmen issued by the Post Office Engineering Department. London: H.M. Stationery Office. Price 6d. net.

Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, W.C.2, have issued their autumn list of new and forthcoming books, the technical section of which includes a number of books dealing with the various branches of electrical engineering.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLVIII. No. 10. October, 1929. New York: The Institute. Price $1.

Bankruptcy Proceedings.

B. Marsh, 17, Victoria Road, Brighton, electrician.—The adjourned public examination of this debtor was held recently at the Court House, Brighton. It was stated by the debtor that in January last he was pressed by creditors, and formed a company, he and another being the only shareholders, and each having a £1 share. In February the debtor purported to assign to the company his assets in consideration of a sum of £100, but he had not received the money. His assets at that time were valued at about £400. On March 4th he was informed that he was allotted six £100 debentures in the company, but he never had them. In July he gave notice to his creditors that he could not pay any more. The examination was concluded subject to the signing of the notes.

R. Green, trading as the Fleet Radio Stores, 143-4, Fleet Street, E.C.4.—This debtor, who also formerly carried on business at 81, Aldersgate Street, E.C., as "The City Sale and Exchange," attended on October 25th at the London Bankruptcy Court for public examination. He failed last April with total liabilities of £14,032 (unsecured £8,189), and net assets valued at £8,735. Questioned by Mr. E. Parke, Official Receiver, the debtor stated that for many years he successfully carried on business as a dealer in photographic materials under the style of "City Sale and Exchange." In 1923 he sold the business to the "City Sale & Exchange, Ltd.," which went into voluntary liquidation in April, 1929. In 1922 he obtained a seven years' lease of the ground floor and basement of 143-4, Fleet Street, at a rental of £850 per annum, and carried on business there as a dealer in radio stores under the style of "Fleet Radio Stores" until the date of the receiving order. From the commencement he traded at a loss, and he had on several occasions endeavoured to dispose of the lease. Witness attributed his failure to his liability under guarantees given on behalf of City Sale & Exchange, Ltd., and to bad trade. The examination was concluded.

G. F. Summers, engineer, 30, Queen's Road, Bayswater.—The public examination of this debtor was held last week before Mr. Registrar Mellor, at the London Bankruptcy Court, the accounts showing total liabilities of £4,672 (unsecured £4,620), and net assets of £88, after deducting £51 for the payment of the preferential claims. In the course of his evidence the debtor stated that in September, 1928, his wife and another person started business as manufacturers of wireless receiving sets and equipment under the name of Sumit Electrical Co., at the above address. He obtained money from his father to finance the business, which was absorbed by Sumit (London), Ltd., on its formation in November, 1928. He subsequently became a director of the company, and held that position when the receiving order was made against his estate. The debtor attributed his insolvency to depreciation in the value of his shares and to liabilities incurred and guarantees given for and on behalf of companies in which he has been interested. The examination was concluded.

A. E. Shapland, Chippenham Cottage, Exmouth, Devon, formerly of Budleigh Salterton, Devon, electrical engineer. The public examination herein was held on October 17th at

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the Castle, Exeter. According to the statement of affairs there were liabilities amounting to £253, against assets of £56, leaving a deficiency of £197. Debtor attributed his failure to insufficient work, and he stated that he worked too cheaply to secure a connection. The examination was concluded.

W. A. HAMMOND, wireless dealer, 31, Middle Street South, Great Driffield.—Trustee, Mr. J. E. D. Stickney, Official Receiver, 37, Scale Lane, Hull, released October 16th.

W. J. BEATY, electrical and wireless dealer, 79, Station Road, Ashington.—Trustee, Mr. R. K. Clark, Official Receiver, 81, St. Mary's Place, Newcastle-on-Tyne, released October 16th, 1929.

E. H. NEWMAN & M. BAYNES (Langham Radio), wireless manufacturers, 96, Regent Street, W.1. Receiving order made October 23rd on a creditor's petition.

J. P. JAMES, wireless engineer, 2a, Neath Road, Hafod, Swansea.—Receiving order made October 21st on debtor's own petition. First meeting November 5th, at the Official Receiver's office, Government Buildings, St. Mary Street, Swansea. Public examination November 22nd, at the Town Hall, Swansea.

H. E. DAFT, electrician, Gloucester Place, Monument Street, Peterborough.—Trustee, W. J. Adnitt, 19, New Road, Peterborough, appointed October 23rd, 1929.

R. R. WRIGHT (WRIGHT BROS.), wireless dealer, 36, Normanton Road, Derby.—Receiving order made October 17th, on debtor's own petition. First meeting held October 31st at the Official Receiver's offices, 22, Regent Street, Park Row, Nottingham. Public examination, November 26th, at the Court House, Derby.

A. J. COLES, electrical engineer and contractor, 2a, Pinner Road, Harrow.—Receiving order made October 17th on debtor's own petition. First meeting November 5th, at 29, Russell Square, W.C.1. Public examination November 27th, at the Court House, St. Albans.

J. CAMEROFF, electrical engineer, 147, Spencer Place, Leeds.—First meeting held October 31st, at the Official Receiver's office, 24, Lower Bond Street, Leeds. Public examination November 12th, at the County Court House, Leeds.

T. C. COTTERELL, electrician, 31, Autumn Street, Burley Lodge Road, Leeds.—First meeting held October 31st at the Official Receiver's office, 24, Lower Bond Street, Leeds. Public examination November 26th, at the County Court House, Leeds.

F. V. LAMBERT (LAMBERT & CURLEY), electrical contractor, 27, Parrock Street, Gravesend.—Application for discharge, to be heard on November 13th at the Court House, Rochester.

H. COHEN (E. COWEN), electrical engineer, &c., 41 & 43, The Village, Lower Bebington, Chester.—First and final dividend of 7d. in the £, payable at the office of the Official Receiver, Government Buildings, Victoria Street, Liverpool.

G. WILMINGTON, electrical and radio engineer, 75, Railway Street, Nelson.— First and final dividend of 2s. 2½d. in the £, payable at the Official Receiver's office, District Bank Chambers, Blackburn.

Company Liquidations.

HUNGERFORD & DISTRICT ELECTRICITY SUPPLY CO., LTD.—A meeting of members is called for November 22nd, at 36, Bedford Row, W.C., to hear an account of the winding up from the liquidator, Mr. A. G. Cox.

ELECTRIC FACTORS (BLACKPOOL), LTD.—A meeting of members is called for November 25th, at 18, Birley Street, Blackpool, to hear an account of the winding up from the liquidator, Mr. J. Todd.

SOUTHERN COUNTIES ELECTRIC LIGHT & POWER SUPPLY, LTD.—Last day for proofs for dividend November 11th. Liquidator, Mr. E. T. Adams, Official Receiver, Carey Street, W.C.

Private Arrangements.

H. HANSON and A. V. JACKSON, trading as "The Avon Electric Co.," Chesnut Street, Liverpool.—A meeting of creditors was held recently at the offices of Messrs. John Airey & Co., Liverpool, when a statement of affairs was submitted which showed liabilities of £454, and net assets of £220, leaving a deficiency of £234. A creditor, however, intimated a further account of about £20, which would increase the deficiency to £254. The debtors commenced business in 1920 with £30 capital. In December, 1927, they estimated that they had a surplus of assets over liabilities of about £100. They then opened a branch for the sale of radio accessories, and as a consequence they became short of capital. Eventually they sold the branch for £350. About six months ago they opened a branch for the purpose of charging batteries, but this had not been successful. No definite offer was forthcoming, and it was suggested that the purchase money of the first branch might be paid to a trustee and the debtors allowed to carry on business. They proposed to increase the amount spread over a period of 12 months, and pay in all a composition of 15s. in the £. The creditors resolved to adjourn the meeting to enable the accountant acting in the matter to investigate the position further. The following are creditors:—

	£		£
B.N.B. Wireless Co. ...	40	Marconiphone Co., Ltd.	51
Edison Swan Electric Co., Ltd.	50	Rowe Bros. & Co., Ltd.	40
		Gilbert & Co.	20

ARTHUR CHARLESWORTH PEEBLES, O.B.E., and ROBERT SHAW (trading as CHARLESWORTH PEEBLES & Co.).—The trustee under the deed of arrangement (Mr. S. H. Gillett, 24, Basinghall Street, E.C.2), states that he hopes to complete the winding-up of the estate during the next two months when a final dividend will be distributed to the creditors.

INTERNATIONAL ELECTRIC CO., LTD.—Mr. R. D. Stoneham, solicitor, 108a, Cannon Street, E.C.4, informs us that the creditors' committee, at a meeting held on October 23rd, passed a resolution advising the creditors to continue the moratorium until November 30th. Mr. Stoneham reported the position with regard to the negotiations which are proceeding for the sale of the business as a going concern.

For Sale.

Salford City Council invite offers for one 5,000-kW turbo-alternator, complete with condensing and auxiliary plant. Hereford gasworks has for disposal d.c. 7½-h.p. motors, complete with tramway-type reversible starters and external resistances, on 5-h.p. motor, and one travelling telpher. Mr. Henry J. Shaw will sell by auction at 13, High Holborn, W.C.1, on November 6th, wireless stocks, electrical accessories and material and electric motors. (See our advertisement pages to-day.)

Prices of Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.	Price Oct. 29th.	Fortnight's inc. or dec.
a	Acid, Oxalic ... ... per lb.	5½d.	...
a	Ammoniac, Sal ... ... per ton	£60	...
a	Ammonia, Muriate (large crystal) ,,	£52	...
a	Bisulphide of Carbon ... ... ,,	...	...
a	Borax ... ... ,,	£25	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... ... per lb.	3½d. to 4d.	...
a	,, Perchlorate ... ... ,,	5½d.	...
a	Shellac ... ... per cwt.	£13 10s.	...
a	Sulphur, Commercial ... ... ,,	£11	...
a	,, Roll ... ... ,,	£11	...
a	Soda, Chlorate ... ... per lb.	3d.	...
a	,, Crystals ... ... per ton	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	3⅝d.	...
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton	£95 to £100	...
b	,, Wire ... ... per lb.	1/1 to 1/9	...
b	,, Sheet ... ... ,,	1/1 to 2/9	...
p	Babbitts Metal and Anti-friction Metals—		
	Grade I ... ... per ton net	£170	£5 dec.
	Grade II... ... ... ,, ,,	£121	£3 dec.
	Grade III ... ... ,, ,,	£68	£1 dec.
c	Brass (rolled metal 2" to 12" basis) per lb.	10½d.	...
c	,, Tubes (solid drawn) ... ,,	1/0½ to 1/1	...
c	,, Wire, basis ... ... ,,	11½d.	...
c	Copper Tubes (solid drawn) ... ,,	1/8	...
g	,, Bars (best selected) ... per ton	£110	...
g	,, Sheet ... ... ,,	£110	...
g	,, Rod ... ... ,,	£110	...
d	,, (Electrolytic) Bars ... ,,	£84 10s.	...
d	,, ,, Sheets ... ,,	£148 10s.	...
d	,, ,, Wire Rods ,,	£94	10/- dec.
d	,, ,, H.C. Wire per lb.	11⅝d.	...
f	Ebonite Rod... ... ... ,,	2/3 to 2/6	...
f	,, Sheet ... ... ,,	2/3 to 2/6	...
n	German Silver Wire ... ... ,,	2/2	...
h	Gutta-percha, fine ... ... ,,	nom.	...
h	India-rubber, Para fine ... ... ,,	9½d.	½d. dec.
i	Iron, Pig (Cleveland No. 3.) ... per ton	86/-	...
l	,, Wire, galv. No. 8. P.O. qual. ,,	£20	...
g	Lead, English pig ... ... ,,	£24 15s.	...
g	Mercury ... ... per bot.	£22 10s. to £22 15s.	...
e	Mica (in original cases) small ... per lb.	8d. to 3/-	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,,	10/- to 20/- & up	...
p	Phosphor Bronze, plane castings ,,	1/3½	...
p	,, ,, drawn bars & rods ,,	1/5	...
p	,, ,, rolled strip & sheet ,,	1/3½	...
p	,, ,, wire... ... ... ,,	1/6½	...
o	Platinum ... ... per oz.	£13 10s.	...
d	Silicium Bronze Wire ... ... per lb.	1/2	½d. dec.
r	Steel, Magnet, in bars ... ... ,,	7½d.	...
g	Tin, Block (English) ... ... per ton	£184 to £185 10s.	£6 15s. to £7 5s. dec.
n	,, Wire, Nos. 1 to 16 ... ... per lb.	3/6	2d. dec.

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Reporting on October 26th, Messrs. James Forster & Co., stated that the lead market opened last week with a weak tone in sympathy with other markets, prices falling 10s. per ton. At this point, however, the agents of the Producers' Association entered the market and bid the price up again to their selling level. Arrivals continue to be short, a fact which is assisting producers to maintain the present price, but more lead is expected to arrive during the remainder of the year. Demand is quiet, transactions being of a hand-to-mouth character. With the producers determined to support prices whenever any weakness shows itself, there is little hope at present of a lower level, although it is doubtful whether the present price is justified by supply and demand.

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Dissolutions of Partnership.

Stanworth & Shorrock, electrical and radio engineers, 1, Rainhall Road, Barnoldswick.—Mr. C. P. Stanworth and Mr. T. W. Shorrock have dissolved partnership. Mr. Shorrock will attend to debts and continue the business.

Auto Electrical Service, electrical engineers, Garrick Place, Wellington Road, South Stockport.—Mr. C. V. Cooper and Mr. H. J. Cooper have dissolved partnership. Mr. H. J. Cooper will attend to debts.

Adams Bros. & Co., electrical engineers, 8, Grand Parade, Westbourne, Bournemouth.—Mr. P. S. Adams, F. H. Adams, E. H. Bond and H. Monk have dissolved partnership. Messrs. P. S. and F. H. Adams will attend to debts and continue the business, under the style of Adams Bros., at the old address.

Ricarda Electric Co., electrical engineers, 16, Holbein Place, Sloane Square, S.W.1.—Messrs. A. A. Bell and R. W. Minshall have dissolved partnership. Mr. Minshall will attend to debts and continue the business.

Lighting and Power Notes.

Aberdeen.—Loans.—The Town Council is to apply for sanction to loans of £60,000 for mains and services, and £9,000 for heating and domestic apparatus.

Accrington.—Change-over.—In connection with the change-over from d.c. to a.c. the Town Council has received sanction to loans of £22,750 for mains, £9,000 for change of motors and £1,500 for meters. The actual cost of the work is estimated at £42,174. The work will be commenced on November 25th, and completed within two years.

Aldershot.—Year's Working.—The accounts of the Corporation electricity undertaking for the year ended March 31st last show a total revenue of £22,865 and a working expenditure of £13,514, leaving a gross profit of £9,351. The figures for the preceding year were:—Income, £23,532; working expenses, £15,148; gross profit, £8,385. From the gross profit had to be met interest on loans, £2,299, and contribution to sinking fund, £2,976, leaving a net surplus of £4,076, as compared with £3,620 in the preceding year. The capital expenditure during the year amounted to £10,197, bringing the total now spent on the undertaking to £89,685. The sales of electricity increased from 1,033,046 to 1,216,100 kWh.

Birmingham.—The Hams Hall Station.—Arrangements for the formal opening by the Duke and Duchess of York on November 6th of the new power station at Hams Hall, were finally decided upon at a recent meeting of the Corporation Electric Supply Committee. It is expected that about 600 people will be present, representing the City, the electrical industry, and large undertakings throughout the country.

Electricity Supply Progress.—The report of progress of the Corporation Electric Supply Department for the September quarter showed an increase of nearly 20 per cent. in electrical energy sold, as compared with the corresponding three months of last year, and 2,950 additional consumers were connected. The new consumers represent an addition of 30,600 60-watt lamps and 8,300 h.p. in power supplies.

Extension of Supply.—The parish of Castle Bromwich has decided upon an electric lighting scheme, and is to enter into a contract with the Birmingham Corporation for the erection of electric standards.

Bolton.—Electricity Meter Concession.—The Corporation Electricity Committee has decided that should an additional ordinary type meter or meters be required by a consumer, in order to enable him to take advantage of the special rates of charge for certain supplies, the necessary meter or meters be provided free of cost provided the monetary value of the electricity consumed, as recorded by each additional meter required, exceeds 10s. per annum. Should this amount not be exceeded, a meter rent will be charged amounting, together with the monetary value of the electricity consumed as recorded by the meter, to the sum of 10s. per annum.

Canada.—Electrical Developments.—The City of Montreal has decided to erect its own power plant with a capacity of 22,000 h.p. to be utilised for street lighting and public buildings. The plant will be erected near La Salle on the St. Lawrence river. The scheme was authorised a year ago and the money voted, but legal difficulties intervened as the city's charter did not authorise it to distribute the surplus power. This obstacle has now been overcome by the acquisition of the charter of the Montreal Water and Power Company, the assets of which have been taken over by the city, and the scheme will be carried out without further delay.

The Premier of Saskatchewan has officially announced that his government intends to adhere to the policy of public ownership of electrical power undertakings. The Power Commission will have its powers enlarged and amplified. Private companies now control power in the majority of the larger towns and villages and it is the intention of the Government to discourage further extensions by private companies of h.p. transmission lines. Negotiations will at once be entered into with the private power companies, with a view to bringing all their holdings under a comprehensive provincial scheme of public ownership.

Continental.—Czecho-Slovakia.—Plans have been drafted for the erection of a power station at Svinov, near Ostrava in Moravia, to supply electricity to the whole of North and Central Moravia as well as Northern Slovakia. The station will have an initial capacity of 42,000 kW, which will be gradually increased to 140,000 kW.

Spain.—*Water Power.*—The Department of Commercial Information of the Spanish Economic Council has recently published the sixth edition of its "Catalogue of Spanish Producers and Exporters" in three languages (Spanish, French and English). It contains an article dealing with Spanish productions from which the following reference to the electrical progress of the country has been taken: "The formidable development of various industries in Spain has been strongly favoured by the general adoption of electric power. The configuration of Spain, which constitutes an obstacle to the direct utilisation of the rivers for the irrigation of the soil, has converted the rivers and rivulets into great reserves of hydraulic energy, which are rapidly being employed. The hydro-electric plants already existing are exploiting more than a million h.p., having besides reserves amounting to half a million, which figures are not even a moiety of the total hydro-electric resources of Spain, the utilisation of which continues incessantly with immediate application to industry, public lighting, and traction. In order to extend the benefits of electrification to those districts which are not in possession of waterfalls, a project of a national electric system is being studied, which comprises the utilisation of the products of certain mines of inferior coal, which project will permit of the creation of thermal reserve stations."

East Ham.—Loans Sanctioned.—The Corporation Electricity Committee has obtained sanction to loans of £7,290 for distributor mains and £1,748 for feeder mains.

Mains Extensions.—The Corporation Electricity Committee has voted £2,059 for the supply and laying of a new lighting feeder cable from the High Street north to Green Street.

Edinburgh.—Year's Working.—We have received from Mr. E. Seddon, engineer and manager of the City electricity supply undertaking, a copy of his report together with a statement of accounts for the year ended May 15th last. The total revenue amounted to £615,876, as compared with £556,887 in the preceding year, and the working expenses were £452,277, as against £312,583, leaving a gross profit of £163,599 (£244,304). To the gross profit a sum of £979 was added from interest on Corporation loans, making a total of £164,578 available. Of this £52,860 was absorbed by interest on loans, £55,102 by contribution to sinking fund and £5,443 by income tax. There remained a net surplus of £51,172, as compared with £16,371 in 1927-28. The capital expenditure during the year amounted to £400,823, the principal items being £72,846 for lands and buildings, £220,115 for machinery and plant at the Portobello station, and £79,851 for mains and cables. The total now spent on the undertaking stands at £4,433,661. The electrical energy sold increased from 101,597,659 to 112,722,006 kWh, and the maximum supply demanded from 48,403 to 52,414 kW. The turbine and switchrooms at the Portobello station were completed by the end of the summer of 1928, and the first of the two new 25,000-kW sets was in commission for the winter load, supplied by steam from the existing boiler plant, the new boiler house not being sufficiently advanced to receive the new plant.

Gillingham (Kent).—Year's Working.—The accounts of the Corporation electricity undertaking show a total revenue of £43,008, a working expenditure of £22,811, and a gross profit of £20,197. The figures for the preceding year were: Income, £37,114; working expenses, £20,376; gross profit, £16,738 After providing for loan interest and repayment there was a net surplus of £10,944, as compared with £7,863 in the preceding year. The capital expenditure amounted to £212,574, and included £86,326 for machinery, and £82,344 for mains and services. The electrical energy sold increased from 2,881,557 to 4,147,148 kWh.

Hove.—Year's Working.—The report on the working of the Corporation electricity undertaking (engineer: Mr. C. B. Smith) for the year ended March 31st last records a total revenue of £76,340, a working expenditure of £42,628 and a gross profit of £33,712. After deducting capital and other charges there was a net surplus of £7,745, as compared with £10,907 in the previous year. The capital expenditure during the year amounted to £11,271, bringing the total now spent on the undertaking to £415,133. The sales of electricity increased from 4,205,067 to 5,269,734 kWh. The average price obtained per kWh fell from 4.03d. to 3.33d.

Ilford.—Loan.—The Corporation Electricity Committee is to seek sanction to a further loan of £50,000 for mains and services.

Keighley.—Loan.—The Electricity Committee has received sanction to the borrowing of £18,090 for mains, sub-stations, and equipment, and fittings for street lighting.

Leigh.—Mains Extension.—The Electricity Committee is to adopt a scheme, estimated to cost £6,929, for laying conduit lines and cables and providing a sub-station and transformer equipment for electricity supplies in Pennington and West Leigh. Application is being made for sanction to a loan. The Unemployment Grants Committee is also being asked for a grant.

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London.—BATTERSEA.—The Borough Council Electricity Committee is to provide electricity services to 131 premises, at a cost of £1,138, and extend and replace mains for private services and public lighting at a cost of £2,560.

The borough electrical engineer has prepared a report showing the following estimates for extensions:—(*a*) Laying mains for private consumers, £29,973; (*b*) laying mains for public lighting and converting gas lamps (£836); and (*c*) providing services, £5,638. The Electricity Committee has selected certain streets which should be dealt with immediately at a cost of £25,729.

WANDSWORTH.—The Borough Council has approved plans submitted by the County of London Electric Supply Co., Ltd., for the laying of electrical conduits in 86 thoroughfares within the borough, and the construction of transformer-boxes in Streatham, Balham, Putney, Tooting, Springfield, and Southfields.

LEWISHAM.—The Borough Council Works Committee has recommended that two miles of the main roads in the borough be provided with improved lighting, one mile to be dealt with by the South Metropolitan Gas Co., and one mile by the South Metropolitan Electric Light & Power Co., Ltd.

Lowestoft.—PUBLIC LIGHTING.—The Corporation Highways Committee is seeking sanction to a loan of £2,500 for the public lighting by electricity of Normanston Drive.

Manchester.—MAINS EXTENSIONS.—The Corporation Electricity Committee is to seek sanction to loans of £250,000 for mains extensions.

NEW TRANSFORMER STATION.—The Committee is to erect a transformer station in Cumberland Street, Deansgate, at a cost of £40,000.

Mexico.—HYDRO-ELECTRIC DEVELOPMENTS.—The Government has granted a Durango engineer a concession for a hydro-electric plant on the Rio Tunal. Preliminary survey work will commence shortly and actual construction will be started within six months after the plans have been approved. The plant must be in working order within two years.—*Reuter's Trade Service* (Mexico).

North Wales Joint Board.—ELECTRICITY SUPPLY PROGRESS.—At a recent meeting of the North Wales and South Cheshire Joint Electricity Authority, a report was submitted on the progress made in electrifying the area controlled by Electricity Distribution of North Wales & District, Ltd. The report stated that up to September 30th over 7,000 consumers had signed contracts with the company. There were now 53 towns and villages in which supply was available, while cabling was under construction for 16 more areas. The supplies, with the exception of that of Welshpool, were purchased in bulk from the North Wales Power Co. Welshpool was at present generating its power at a local timber mill. Arrangements had been made and work commenced on transmission lines from Oswestry *via* Llangollen to Glyn Ceiriog; also from Oswestry to Welshpool. This would form the first part of a line through Montgomery in the direction of Newtown. A line from Nantwich to Oswestry, to supply Whitchurch and Ellesmere, was planned. With regard to Anglesey, negotiations were reported as being well advanced for the construction of a line from Beaumaris to Holyhead, at which town the railway company would also be supplied. An investigation into the entire scheme would shortly be made.

Perthshire.—ELECTRICITY SUPPLY.—It was stated at a meeting of Pitlochry Special District Committee, held on October 25th, that a sub-station on the Arbroath-Rannoch transmission line would be erected at Gatehouse, above Pitlochry, from which lines would radiate to Ballinluig and Dunkeld, as well as Pitlochry. Plans were approved for a sub-station at Hillview, Pitlochry, and a similar station to be erected to supply Moulin.

Portsmouth.—LOANS.—The Corporation Electricity Committee is to seek sanction to the following loans:—£100,000 for mains and services; £40,000 for sub-station equipment; £10,000 for h.p. mains in the city; and £2,700 for transformer kiosks.

Reigate.—SHOP-WINDOW LIGHTING.—The Corporation Electricity Committee has arranged with the Chamber of Commerce to give a supply of electricity for shop-window lighting at any time at 4d. per kWh, in place of the ordinary charge of 5½ per kWh.

Sevenoaks.—SPECIAL ORDER.—The Electricity Commissioners have submitted to the Ministry of Transport for confirmation a Special Order made by them authorising the Sevenoaks and District Electricity Co., Ltd., to supply electricity in part of the rural district of Godstone.

Spalding.—ASSISTED WIRING SCHEME.—The Urban District Council has decided to introduce a scheme of assisted wiring for private houses, at an inclusive price per kWh through prepayment meters in the whole area of supply. Applications will not be considered if an extension of mains is necessary.

Stoke-on-Trent.—MAINS EXTENSIONS.—The Corporation Electricity Committee has decided to extend mains from the proposed sub-station at Greengate Pottery, at a cost of £6,000, from the Etruria sub-station along Garner Street to a sub-station to be erected, at a cost of £3,200, and to the housing estate being developed west of Stuart Avenue, at a cost of £1,000.

Strood.—MAINS EXTENSIONS.—The Rural District Council has agreed to an application by the Kent Electric Power Co. for permission to extend its mains, partly overhead and partly underground, from Rochester to Snodland.

United States.—ELECTRICAL DEVELOPMENTS.—According to *Power* the installation of the world's largest single-cylinder turbine was completed recently at the Cahokia generating station of the Union Electric Light & Power Co., of St. Louis, Mo. The new unit adds 75,000 kW to the St. Louis plant. It is 50 per cent. larger than any installed by the company up to the present and replaces a 35,000-kW turbo-generator less than six years old, which has been removed and set up in the company's station at Venice, Ill.

The total capacity of the Charles R. Huntley steam plant, of the Buffalo, Niagara & Eastern Power Corporation, will be 540,000 h.p. when plans recently announced are completed. In addition to the 107,000-h.p. unit, which is now under construction, a second turbo-generator of 100,000 h.p. will soon be constructed. There is also a possibility that another 100,000-h.p. steam plant may be established at Niagara Falls in the near future with a view to serving certain industries there whose expansion has been retarded due to their inability to secure sufficient hydro-electric power. Several developments in the hydro-electric field in the West are in hand. The Inland Power & Light Co. is proposing to construct two dams and power houses on the Lewis River in Cowlitz and Clark Counties, Washington. On one site the proposed initial installation is 40,000 kW, and the ultimate installation 150,000 kW. At the other site it is proposed to install initially 50,000 kW and ultimately 200,000 kW.

The directors of the Pennsylvania Water & Power Co. have decided to undertake the immediate construction of a new dam and power house at Safe Harbour, Pa., which is eight miles upstream from the Holtwood plant of the company, from which river power is transmitted to Baltimore. The initial development at Safe Harbour will have a total capacity of approximately 230,000 h.p., but the power house foundations will be designed for an ultimate capacity of over 500,000 h.p. The initial project will involve an expenditure of upwards of $30,000,000. Construction work will begin next spring. The two hydro-electric developments at Safe Harbour and Holtwood will ultimately provide a total capacity in excess of 650,000 h.p.

Whitburn.—ELECTRICITY SUPPLY PROPOSAL.—The Town Council has received a proposal from the Scottish Central Electric Power Co., to light the town by electricity.

Tramway and Railway Notes.

Birkenhead.—RAILLESS CARS.—The Corporation proposes to promote a Parliamentary Bill for powers to substitute railless cars for its present tramway system.

Continental.—SWITZERLAND.—Diesel-electric motor coaches are being adopted in place of steam locomotives on the Appenzell railway, which runs between Gossau (St. Gall) and Appenzell, a distance of 16 miles, including gradients up to 1 in 27. The two first coaches were built by the Swiss Industrial Co., of Neuhausen, the Oerlikon Co. being responsible for the electrical equipment, and Sulzer Bros., of Winterthur, for the Diesel engines.

Japan.—RAILWAY'S ELECTRICITY SUPPLY.—The Tobu Railway Company is considering a scheme for the generation by means of Diesel engines of its own supply of electricity. It is stated that a supply of 200,000 kW is required by the company.

Liverpool.—RAILLESS CARS.—A report is to be prepared for the City Council on the possibility of running railless cars in the outer areas and on crossing routes.

London.—IMPROVED TRAMWAY SERVICES.—The Metropolitan Electric and London United Tramway Companies introduced the following improvements in their services last Wednesday: (*a*) A new rush-hour service from Paddington to Edgeware (*via* Cricklewood) on an eight minutes' headway; (*b*) Service 60, Paddington to North Finchley, extended to Barnet on Saturdays; (*c*) A new week-day service between Hammersmith and Brentwood, *via* Ealing and Hanwell; (*d*) Later cars on the Kingston and Tolworth service.

BREAKDOWN.—The failure of the electricity supply caused a delay lasting 20 minutes of District Railway trains between Bow Street and Barking during the morning of October 24th.

Middlesbrough.—TRAMWAY BILL OPPOSITION.—The Corporation Tramways Committee has decided to oppose the Stockton Town Council's proposed Parliamentary Bill for power to substitute motor-'buses for trams. The Tees-side tramway undertaking is owned jointly by the Corporations of Middlesbrough, Stockton, and Thornaby.

The Southern Railway.—BREAKDOWN.—The breakdown of the lighting and signalling systems shortly after 8 p.m. on October 22nd caused a delay lasting as long as two hours of many of the electric and main line services on the Chatham section of the Southern Railway.

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Telegraph and Telephone Notes.

Australia.—AN ANOMALOUS POSITION.—Amalgamated Wireless (Australasia), Ltd., after an interval of twenty-one months, has published its balance-sheets for the past two years. They show profits of £47,000 and £80,000, and dividends of 6 and 8 per cent., respectively. The company previously had paid no dividends and made no profits, says the *Daily Telegraph*. The Commonwealth subscribed capital shown on the balance-sheet as at June 30th is £744,000, while the Commonwealth contribution is £300,000, which is £73,000 below a majority holding. The Commonwealth contribution covers practically the whole cost of the beam radio-telegraph services, which is recorded in the balance-sheet as £304,000. Regarding the combined working of the cable and wireless services, the Amalgamated Company is the only organisation in the Empire which has not co-operated in the amalgamation. An anomalous position thus exists by which the Amalgamated Company cannot dispatch a single word either to England or Canada without the willingness of the Communication Company to receive the messages, and it therefore has no complete international service itself.

Cuba.—COMMUNICATION SERVICES.—There are now 12,231 miles of telegraph wires in operation in Cuba, or about 3.4 miles per 1,000 of the inhabitants. The number of telephone instruments in use on the island is given as 63,834, or 17.9 per 1,000 of the population.

Reuter's Trade Service learns from Habana that plans for the immediate development of the telephone service are in preparation, including the construction of a secondary long-distance route from Habana to Santiago-de-Cuba, opening up a wide new territory, and the provision of an emergency route for the main-line service.

Jamaica.—TELEPHONE COMPANY SOLD.—The Island is attracting more and more English capital, the latest example being the acquisition of the Jamaica Telephone Co. by an English syndicate. The company has a forty-year licence.

Northern Ireland.—FARMERS' TELEPHONES.—At a recent meeting of the County Tyrone Agricultural Committee a resolution was received from the County Armagh Committee of Agriculture urging the need for the extension of the telephone service all over Northern Ireland, so as to provide farmers with facilities to keep in touch with the markets. Mr. T. Hegan supported the proposal, and suggested that the Ministry of Commerce of Northern Ireland be requested to give attention to the matter in the interest of the farming community which wished to install telephones for business purposes. The Committee approved of the suggestion.

Peru.—SUBMARINE CABLES.—A concession has been granted to All-America Cables to lay submarine cables for telephony, the terms specifically stating that the cables that exist to-day, or may be laid in the future, may be used for telegraph and telephone communication, or simultaneously for both. The concession stipulates that within two years the company must erect stations for wireless telegraph communication with the United States, Spain, Argentina, Chile, and Central America, and for wireless telephony communication with Spain, with connections to other parts of Europe and to Argentina, Chile, and the United States.—*Reuter's Trade Service* (Lima).

Portugal.—WIRELESS TELEGRAPHY.—There is now direct wireless telegraph communication between Macao and Lourenco Marques, Portuguese East Africa, and it is hoped to open the service to the public very shortly.—*Reuter's* (Lisbon).

Transatlantic Telephony.—PREPARATIONS FOR CABLE.—The ocean bed off the coast of Mayo is being tested by engineers of the American Telephone & Telegraph Co. in preparation for the new Atlantic telephone cable. The chief aim of the tests is to disclose deposits of iron ore, which, if they exist in any considerable quantity, will seriously interfere with the working of the cable. So far they have proved satisfactory; soundings have been taken and several lengths of test cable laid, which are experimental and temporary, in twenty-mile lengths and joined up as the work progresses. When the time arrives for laying the permanent cable, it will be paid out in one continuous length from a cable ship. It is possible that this circuit will be available for service as early as 1932. The new cable will yield only one additional telephone channel, but it will be of maximum reliability, free from the variations characteristic of radio circuits. It is probable that a superposed telegraph channel will also be obtainable. The route is not yet settled in detail, but it is probable that the main transatlantic link will extend directly from Newfoundland to Ireland, a cable length of approximately 1,800 nautical miles. From Ireland the circuit will probably be carried through submarine cable to Scotland, thence by land cable to London, where it will terminate. It is expected that from Newfoundland the circuit will be carried through several sections of submarine cable to Nova Scotia, thence by land circuits through Nova Scotia, New Brunswick, and the New England States to New York City, which will be the other terminal.

Radio Notes.

Australia.—FINANCE.—That the Australian Broadcasting Company, which is supplying programmes for the national broadcasting service of the Commonwealth Government, is losing heavily in its efforts to give a better service to the listening public was revealed recently, says *World-Radio*. During the hearing of a dispute between the company and the Musicians' Union, before the Commonwealth Arbitration Court, the chairman of directors of the A.B.C. said that the company could not afford to pay the extra amount asked for by the musicians. On the present basis of operation, the company was losing at the rate of between £10,000 and £15,000 a year. He did not think it would be able to balance things for two years, as it would not control all the "A" class stations until then. It would be impossible to bear any additional burdens without having to reduce the standard of entertainment.

Empire Broadcasting.—NEW SHORT-WAVE STATION.—It is reported that the British Broadcasting Corporation is to build a new long-distance short-wave transmitter. It is stated that tenders have been received from builders, and the new station will probably be situated at Daventry, where there is land to spare.

France.—NEW SHORT-WAVE TRANSMITTER.—A new short-wave station, called "Paris Experimental Radio," has been opened, its power being 2 kW and its wavelength 31.65 m.

Station Interference.—HETERODYNE ON GLASGOW.—For some weeks past Glasgow listeners have been complaining that their reception of that station has been interfered with by a high pitched whistle, due to the heterodyne produced by the Spanish station, San Sebastian, EAJ8, which has been working on a frequency not allotted to it under the Prague plan. The station was identified and its frequency measured by the engineers at the B.B.C. listening post at Tatsfield and found to be 755 kilocycles per second, approximately: the frequency of the Glasgow station, which has been strictly adhered to, is 752 kilocycles per second (399 metres). The interference was at once reported to the Technical Committee of the Union Internationale de Radiophonie at Brussels. The identity and frequency of the interfering station were confirmed at the U.I.R. listening post at Brussels, and it immediately communicated by telegram with the Spanish authorities. Further, the B.B.C. requested the British Post Office to make representations to the Spanish administration, in accordance with the provisions of the Prague plan, which request was complied with immediately. It is hoped that the action taken will be effective and that the grievance of Glasgow listeners will be removed.

High-pressure Station Reliability.

The N.E.L.A. prime movers committee's report cites the following operating experience of the Milwaukee Electric Railway & Light Co., with a 1,300-lb. boiler and 7,000-kW turbine in a station designed for 300-lb. pressure:—

Period.	May to December, Inclusive, 1928.	Year 1928.
Elapsed hours	5,880	8,761
Boiler hours	5,035	6,945
Boiler use factor	86	79.4
Turbine hours	4,785.2	5,993.6
Turbine output, million kWh ...	30.97	39.23
Turbine use factor	81	68
Turbine load factor	75	64.5

Erosion of the bronze impellers has prompted the installation of steel ones.

The high-pressure equipment has necessarily carried its full quota of station load over the recent winters and from all standpoints has proved its commercial value. A second boiler unit has been purchased and plans for the quite near future contemplate the installation of two more boilers and attendant high-pressure turbines.

The Edison Electric Illuminating Company, of Boston, reports that the longest continuous run of the new 10,000-kW high-pressure turbine to date (February 9th, 1929), is 172 hours. Although the turbine could have been run almost indefinitely, a longer run was not made because of low steam load on the station.

The Union Gas & Electric Company, of Cincinnati, has a 600-lb. unit and the longest continuous turbine run has been for 54 days, while rebuilding the second turbine from a 45,000-kW tandem-compound unit to a cross-compound unit of 63,000 kW capacity. During this same period the reheat boiler for the turbine operating had a continuous run of 26 days. It was taken off the line due to an economiser tube leak.

Turbine inspections have indicated that no undue erosion took place on turbine blades due to the higher steam density. A number of stages in the exhaust end of the low-pressure turbines were originally bladed with thin-edged blades. Cracks developed in these blades and they were replaced with ones of greater cross-sectional area and redesigned dovetails.—*Electrical World*, September 7th, 1929.

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Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—November 27th. City Council. 6,600-V, 3-phase switchgear. (B.X. 5708.)*
December 10th. Posts and Telegraphs Department. Switchboard keys and parts. (B.X. 5776.)* Electric lamps, lamp caps, and lamp sockets for telephony purposes. (B.X. 5783.)*
December 17th. Telephone fuses, heat coils, and protectors. (B.X. 5784.)* Loading-coil pots. (B.X. 5785.)* Secondary batteries. (B.X. 5777.)*
November 27th. Victorian Government Railways. Automatic oil switches. (B.X. 5735.)* Indication transformers for railway signalling, with a no-load ratio of 100/6 V. (B.X. 5737.)*
March 30th.—D.c. neutral relays for power-signalling purposes. (B.X. 5793.)*
December 9th.—State Electricity Commission of Victoria. 3,000-kVA transformers and spares. (B.X. 5775.)*

Bridgend.—November 18th. Mid-Glamorgan Water Board. Pumping station and ancillary works at Schwyll, Ewenny, near Bridgend. Electric transformers, switchboard, meters, &c. Electric lighting, two centrifugal pumps, heating apparatus, electrical depth transmitters on various reservoirs, with cables and electric lines connecting with the pump house. Specifications from Messrs. Thomas & Morgan & Partners, Pontypridd.

Bo'ness.—November 4th. Town Council. Electric lighting installation for the housing scheme. Mr. Wm. Beattie, Director of Housing, Burgh Chambers, Bo'ness.

Canada.—TORONTO.—November 5th. Department of Works. One 10-million gallon centrifugal pump and electric motor complete with bed-plate, switchboard and accessories. (A.X. 8703.)*

Chile.—SANTIAGO.—November 14th. Chilean State Supply Department. Telegraph material. (B.X. 5746.)*

Derby.—November 4th. Derbyshire County Council. Electric lighting installation at Bretby Hall Hospital, near Burton-on-Trent. Messrs. Martin & Martin and T. H. Ward, 106, Colmore Row, Birmingham. (Deposit £1 1s.)

Edinburgh.—November 11th. Parish Council. Installation of Lancashire boiler, &c., at Craiglockhart Poorhouse. Schedules from Mr. J. M. Johnston, 47, Charlotte Street, Leith.

Egypt.—CAIRO.—November 19th. Ministry of the Interior. One Diesel-electric generating set for the Manfalout power station. (B.X. 5720.)*
November 30th. Diesel engine-driven electric lighting installation at Abou-Tig (Assiut Province). (B.X. 5791.)*

Fife.—November 20th. Education Authority. Electrical work at reconstructed Cowdenbeath School. Schedules (£1 1s. deposit) from Mr. George Sandilands, architect and master of works, Education Offices, Kirkcaldy.

India.—DELHI.—India Stores Department. November 12th. Battery charging motor-generators and oil switch. (B.X. 5774.)*
November 7th. Electric cables for 12 months. (B.X. 5808.)*
November 14th. Crude-oil engine-driven d.c. generating set and a motor-generator set, with switchgear, for the Military Engineering Services, Razmak. (B.X. 5744.)*
November 18th. Two 20-kW oil-engine-driven d.c. generators, water-softening plant, and overhead travelling crane. (B.X. 5757.)*
November 15th. Bombay, Baroda, and Central India Railway Co. Primary battery, supplies, gasfilled and vacuum lamps, and overhead contact wire and stranded catenary cable. (See this issue.)

London.—CENTRAL ELECTRICITY BOARD.—November 9th. Supply, delivery, and erection of 33,000-V overhead transmission lines in South Lincolnshire. (September 27th.)
HANWELL.—November 23rd. Managers of the Central London School District. Motor with reduction gearing, starter, &c. (See this issue.)

New Zealand.—WELLINGTON.—Post and Telegraph Department. November 18th. Resistance spools. (B.X. 5716.)*
November 19th. Telephone transformers. (B.X. 5718.)* Automatic wall and table telephones. (B.X. 5717.)*
March 11th. Public Works Department. 110-kV switchgear for interconnecting auto-transformers for the Waikato power scheme. (B.X. 5797.)* Switchgear and controlling equipment for Timaru. (B.X.5798.)* 66-kV switchgear and protective system for Lyttleton, Lake Coleridge scheme. (B.X. 5796.)*

South Africa.—JOHANNESBURG.—November 14th. S.A. Railways and Harbours Board. Telephone cable, terminal strips and paper sleeves. (B.X. 5813.)‡
BLOEMFONTEIN.—December 2nd. Waterworks Department. Two low-lift and two high-lift electrically-driven pumping units, with cables, starters, &c. (A.X. 8710.)

Warrington.—November 18th. Electricity Department. E.h.p. sub-station switchgear. (See this issue.)

Wolverhampton.—November 15th. West Midlands Joint Electricity Authority. Two 6,600-kVA, two 1,200-kVA, and two 150-kVA transformers for Ironbridge power station. October 25th.

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Birmingham.—Education Committee. Accepted:—
Electrical installations at schools.—Harrison & Searle, Ltd. (£763); Lea, Son & Company (£401 and £616).

Brighton.—Lighting Committee. Accepted:—
Tube heaters (£190).—Siemens Bros. & Co., Ltd.

Croydon.—Electricity Committee.
Switchgear for generating station extensions:—

ENGLISH ELECTRIC CO., LTD. (Accepted) ...	£47,220
British Thomson-Houston Co., Ltd. ...	49,103
General Electric Co., Ltd.	49,223
A. Reyrolle & Co., Ltd.	49,969
Metropolitan-Vickers Electrical Co., Ltd. ...	50,538
Ferguson Pailin, Ltd.	51,069

Boiler house:—

John Thompson, Ltd.	£84,954
International Combustion, Ltd.	86,545
" " (powdered fuel scheme)	86,658
BABCOCK & WILCOX, LTD. (Accepted) ...	108,809
Stirling Boiler Co., Ltd.	108,865
Vickers Boiler Co., Ltd.	113,840

Cooling tower and circulating water culvert. One concrete tower—Van Iterson type, 164 ft. high:—

A. E. FARR (Accepted)	£18,753
Wilson Lovatt & Sons	20,291
Yorkshire Hennebique	20,365
Joshua Henshaw & Sons	22,650
L. J. Speight, Ltd.	22,654
Foundation Co., Ltd.	26,290

Turbo-alternator:—

METROPOLITAN-VICKERS ELECTRICAL CO., LTD. (Accepted)	£76,851
Ditto	74,396
C. A. Parsons, Ltd.	74,640
Ditto	74,980
British Thomson-Houston Co., Ltd.	76,200
Ditto (Alternative)	78,543
Ditto (Alternative)	77,625
Ditto (Alternative)	77,963
Ditto (Alternative)	74,241
English Electric Co., Ltd.	71,260
Ditto	79,512
Ditto	81,860
Ditto	84,801
Richardson, Westgarth & Co., Ltd.	77,800
Ditto	76,550
Ditto	76,500
Ditto	75,150
Ditto	73,900
Ditto	73,850
Fraser & Chalmers Engineering Works ...	73,147
Ditto	75,647
Brush Electrical Engineering Co., Ltd. ...	71,220

Electric tower-wagon (£475).—Electricars, Ltd.

Irish Free State.—DUBLIN.—Controller of Stores, Posts and Telegraph Department. Contracts placed during September, 1929:—
Cable.—British Insulated Cables, Ltd.; Siemens-Schuckert (Ireland), Ltd.; F. Routledge.
Creed teleprinters.—Standard Telephones and Cables, Ltd.
Electric light fittings, &c.—Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.

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Generators.—Ericsson's Telephones, Ltd.
Bronze insulated wire and flameproof wire.—Pirelli-General Cable Works, Ltd. —*Irish Electrician.*

London. — London County Council. — Highways Committee. Eight rotary convertors for manual operation :—

British Thomson-Houston Co., Ltd. ...	... £23,802
Metropolitan-Vickers Electrical Co., Ltd.	... 23,802
Bruce Peebles & Co., Ltd.	... 23,802
English Electric Co., Ltd.	... 23,802
General Electric Co., Ltd.	... 23,802
Mather & Platt, Ltd.	... 23,802
A. Reyrolle & Co., Ltd.	... 23,802
Electric Construction Co., Ltd.	... 24,090
Crompton Parkinson, Ltd.	... 26,242
Oerlikon, Ltd.	... 27,526
Ditto (Alternative)	... 29,530
Harland Engineering Co., Ltd.	... 28,041
Electric Motor and Transformer Co. ...	... 29,582
British Brown, Boveri, Ltd.	... 34,152
Hewittic Electric Co., Ltd.	... 39,084

The committee has accepted in part the tender of the British Thomson-Houston Co., Ltd., to supply and install six machines (for £16,853) and also the tender of Metropolitan-Vickers Electrical Co., Ltd., so far as relates to the supply and installation of two machines (for £6,949).

One rotary convertor :—

	Supervisory control.	Remote automatic control.	Remote semi-automatic control.
Oerlikon, Ltd.	† £4,255	—	—
(Alternative) ...	4,515	—	—
British Thomson-Houston Co., Ltd. ...	5,568	—	—
Metropolitan-Vickers Electrical Co., Ltd.	£5,568	£5,168	£4,848
English Electric Co., Ltd.	5,568	—	—
General Electric Co., Ltd.	5,568	5,166	4,848
Bruce Peebles & Co., Ltd.	—	—	4,848
Mather & Platt, Ltd. ...	—	—	4,848
A. Reyrolle & Co., Ltd.	—	—	4,848
British Brown, Boveri, Ltd.	6,299	—	—
Harland Engineering Co., Ltd.	6,467	—	—
Crompton Parkinson, Ltd.	6,558	—	—
(Alternative) ...	—	—	4,985
Electric Construction Co., Ltd.	—	—	5,200
Hewittic Electric Co., Ltd.	—	—	6,637

†Tender incomplete.

The Committee has accepted the Metropolitan-Vickers Co.'s tender for a convertor with supervisory control.

Battersea Power Station.—The London Power Co., Ltd., has placed a contract for the supply and erection of the constructional steelwork for the first section of the new power station with Sir Wm. Arrol & Co., Ltd.

Stoke Newington.—Electricity Committee. The Council has referred back for further consideration the contract for wiring work in private premises under the Council's assisted wiring scheme.

St. Marylebone. Electricity Supply Committee :—
One portable relay testing transformer set (£450).—Metropolitan-Vickers Electrical Co., Ltd.

Poplar.—Electricity Committee. Recommended :—
Cables (£405).—Standard Telephones & Cables, Ltd.

Staffordshire.—Education Committee. Accepted.
Installation of electric light at Newcastle High School (£255).—Etna Lighting & Heating Co., Ltd.
Electrical installation at Orme Girls' Schools extension (£269).—N. G. Bailey & Co.

Wolverhampton.—Education Committee. Accepted :—
Installation of electric light at the Grammar School (£369).—W. G. France.

Forthcoming Events.

Institution of Mechanical Engineers.—Friday, November 1st. Institution, Storey's Gate, S.W. 6 p.m. Thomas Hawksley lecture, "Critical Relations between Water and Steam." Prof. H. L. Callendar.

Electrical Power Engineers' Association (West Yorkshire Section).—Saturday, November 2nd. Great Northern Hotel, Leeds. 5.30 for 6 p.m. Annual dinner.

Salford Technical & Engineering Association.—Saturday, November 2nd. Royal Technical College. 7 p.m. Short papers by members in competition for the Gold Medal awarded by Mr. W. O. Larmuth.

Institution of Civil Engineers.—Tuesday, November 5th. Institution, Gt. George Street, S.W. 6 p.m. Presidential address. Mr. W. W. Grierson.

Television Society.—Tuesday, November 5th. Engineers' Club. 8 p.m. "Amplification and Television." Mr. F. Langford-Smith.

Electrical Society of Glasgow.—Tuesday, November 5th. 30, Gordon Street, Glasgow. 7.30 p.m. "Light in Health and Disease." Dr. E. Mudie.

Association of Mining Electrical Engineers (London Branch).—Tuesday, November 5th. Junior Institution of Engineers, 39, Victoria Street, S.W. 6.30 p.m. Presidential address by Mr. J. W. Robinson.

Institution of Heating & Ventilating Engineers.—Wednesday, November 6th. Swedenborg Hall, 29, Hart Street, Bloomsbury, W.C. 7 p.m. "Notes on Electric Warming, with special reference to Low Temperature Panel Systems." Mr. R. Grierson.

Edinburgh Electrical Society.—Wednesday, November 6th. 16, Royal Terrace. "Colour Lighting in Theatres." Mr. R. Gillespie Williams.

Smoke Abatement Exhibition.—November 6th-16th. City Hall, Manchester.

Royal Society of Arts.—Wednesday, November 6th. John Street, Adelphi, W.C. 8.30 p.m. Inaugural meeting, address by the Chairman of the Council, Mr. Ll. B. Atkinson, on "Fifty years of Electrical Science and Industry."

Institution of Electrical Engineers.—Thursday, November 7th. Institution, Savoy Place, W.C.2. 6 p.m. "The Analysis and Measurement of the Noise Emitted by Machinery." Mr. B. A. G. Churcher and Mr. A. J. King.

Informal Meeting.—Monday, November 4th. 7 p.m. "Discussion on Paris and the Pyrenees: notes on some of the Technical Features of the I.E.E., 1929, Visit." Opened by R. Borlase Matthews.

(Wireless Section).—Wednesday, November 6th. Institution, Savoy Place. 6 p.m. Inaugural address by the chairman, Captain C. E. Kennedy-Purves, R.N.

(Mersey & North Wales (Liverpool) Centre).—Monday, November 4th. The University, Liverpool. 7 p.m. "The Construction of the Grid Transmission System in Great Britain." Messrs. Johnstone Wright and C. W. Marshall.

(North-Eastern Students' Section).—Friday, November 8th. Armstrong College, Newcastle-on-Tyne. 7.15 p.m. "Centrovisory Control of Power Stations." Mr. B. H. Leeson.

(Meter & Instrument Section).—Friday, November 1st. Institution, London, W.C. 7 p.m. Inaugural address by the chairman, Mr. E. W. Hill.

International Commercial Motor & Transport Exhibition.—Olympia, W. November 7th-16th.

Institution of Engineering Inspection.—Thursday, November 7th. Hyde Park Hotel. Annual reception and dance.

Electrical Trades Benevolent Institution.—Thursday, November 7th. Portman Rooms, Baker Street, W.1. 8 p.m. Ball and cabaret organised by the London Branch of the E.C.A.

Physical Society.—Friday, November 8th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

Junior Institution of Engineers.—Friday, November 8th. 39, Victoria Street, S.W. 7.30 p.m. Annual general meeting.

Illuminating Engineering Society.—Friday, November 8th. "Modern Incandescent Lighting in Kinema Studios." Messrs. W. H. Villiers and S. G. Double.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of makers of the following :—

Saluta domestic appliances.
Daylight signs marked Rein Cr Lite Solal.
Stackpole brushes.
Ballot lighting sets.
Standard motors.
Operating theatre fitting catalogued under No. Q. 540.

The Acquisition of Electricity Undertakings in the Irish Free State.

At a meeting held recently between representatives of the Irish Free State Electricity Supply Board and the Provincial Electricity Suppliers' Association, it was decided that an Arbitration Board should be set up to settle disputes regarding the purchase price of electricity undertakings which the Board might wish to acquire. Under this agreement the Board will nominate one arbitrator and the Association another, who between them will elect an umpire.

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Notes.

The Kennedy Memorial.

It is hoped to complete as soon as possible the fund for a permanent memorial to the late Sir Alexander Blackie Kennedy, the distinguished engineer. It was resolved in 1926 to endow the Chair of Mechanical and Civil Engineering at University College, London, which he occupied from 1874 to 1889, as a tribute to his work and worth. The amount required was £30,000, towards which £18,035 has been subscribed. There remains a balance of £11,956 to be raised, and subscriptions to the fund should be sent to Lord Meston at University College, Gower Street, London, W.C.1.

Modern Street Lighting.

Modern street-lighting problems formed the subject of a lecture by Mr. W. J. Jones at the E.L.M.A. Bureau at Savoy Hill, W.C.2), at the opening meeting for the 1929-30 session of the London Local Technical Group of the Electrical Power Engineers' Association, on Tuesday of last week.

Mr. Jones considered the most serious difficulty to be the allocation of funds for street lighting. About 5d. in the £ (ratable value) was expended in London, as an average. He emphasised that visibility was not the sole criterion, and shopkeepers expected the street lighting in the vicinity of their shops to be of a very high standard. In artificial light, and even in daylight, distant vision was attained by silhouette. The more the light available, the greater the power of the eye to perform its function. The buildings provided surfaces against which objects were silhouetted, and so influenced visibility. If lighting units were mounted high, well away from the object one was looking at, glare was reduced considerably, but if we could eliminate glare entirely, visibility would be very dull. Improvement in eye comfort had resulted from the substitution of pearl or opal lamps for the clear gas-filled lamps. In London there were about 35 different bodies responsible for street lighting, and in some cases one side of the road was very well lighted with electric lamps on modern standards, whilst on the other side obsolete gas lighting was provided. A central body had taken over the whole of the street lighting of Berlin, and considerable improvement had been effected. There should be an *ad hoc* body to deal with the co-ordination of the street lighting in the main areas of London. Mr. Jones demonstrated, by means of a model street, the effect of increasing the number of posts, and of shop lighting, &c., compared with central and side lighting.

In the subsequent discussion, Mr. L. E. Buckle (G.E.C.) suggested that the best procedure was to influence public opinion by demonstrating a good lighting installation and indicating what it would cost. Good street lighting inevitably helped load building, because shopkeepers appreciated the importance of making their shops stand out.

Mr. Jeffery (Charing Cross, West End & City Co.) urged that the provision of adequate street lighting was a national and not a parochial matter. Just as the Ministry of Transport had classified roads, those responsible for lighting should classify the different types of lighting—as had been done partly in the B.E.S.A. specification. The London County Council, he believed, was the first road authority to call for illumination of the B.E.S.A. specification Class B standard, which required a minimum of 1 ft.-candle on the road surface at the point of minimum illumination. The height of the lamps was 30 ft., with the result that the ratio between the spacing and the height of the lamps was very low, *i.e.*, 4.6. That had its effect in reducing glare. The whole contract was subject to the conditions of the B.E.S.A. specification.

Several other members also took part in the discussion. Mr. Jones, in reply, said that already no less than 33⅓ per cent. of the total street lighting in this country was electric. The lowest possible charge should be made for electricity for street lighting, because it represented a load factor of 50 per cent., with an all-night service. Further, new consumers were secured as the result of the use of electricity in the streets. The percentage failures of lamps which had burned for 1,000 hours was comparatively heavy, but by replacing them periodically, after they had had a reasonable life, one would be able to save much of the expense involved in watching. On several systems it was the rule to replace lamps after 800 hours, whether they had burned out or not. The public did not feel it was getting value for money if the light sources were entirely screened; though engineers should do their utmost to reduce glare to a minimum, they should leave something bright to look at.

West Ham Electricity Department.

A dinner was arranged by the staff last Monday at the Holborn Restaurant, W.C., to bid farewell to Mr. F. W. Purse, M.I.E.E., on his taking up the position of chief engineer to the London and Home Counties J.E.A., and to welcome Mr. J. W. J. Townley, M.I.E.E., his successor as chief engineer and manager to the West Ham undertaking.

The Mayor of West Ham (Alderman W. T. Bell, J.P.) presided over a gathering of about 200, including some 150 guests. He referred to the great improvement in the financial position since Mr. Purse took charge ten years before. Tariffs had been reduced, and supplies given to other boroughs.

Mr. Purse averred that the credit was due, not to his own efforts, but to the support given him by the chairman of the electricity committee (Alderman W. Croot), and to the fine team work of his staff. The presence of Mrs. Gregory (chairman E.A.W.) on the electricity committee had assisted development in the domestic field. Relations with the West Ham Power Users' Association (represented at the dinner) were excellent. Alderman W. Croot welcomed Mr. Townley (whom he had known for several years in connection with No. 10 D.J.I.C.) as a worthy successor to Mr. Purse, to whose character and abilities he paid a striking tribute.

Mr. Townley, responding, said that a high standard had been set for him. Though he had been at West Ham for only 28 days, he had found that the duties of his predecessor had been manifold, and that the staff was a very fine one.

Mr. W. A. Gilbert toasted the guests, for whom Miss C. Haslett (director E.A.W.) and Mr. Robert Smith (Drake and Gorham) replied. Miss Haslett referred to the sympathy, as well as criticism, received by the E.A.W. from Mr. Purse, and to her expectations of the same support from Mr. Townley.

Mr. W. F. Egerton proposed a vote of thanks to the chairman, and Alderman Bell responded.

The Electrical Association for Women.

On Thursday, October 10th, 1929, a large party of London members visited the showrooms of Messrs. Kelvinator, Ltd., 29, Kingsway, W.C.2. Members were received by Mr. Browne, who afterwards gave a very interesting lecture on "Electrical Cold that Keeps." It was evident from the questions asked that women are keenly aware of the importance of refrigeration and the various methods which may be used in connection with the preservation of food. Much interest was taken in the inspection of the refrigerating cabinets in the showroom. During tea, Mrs. Hammer proposed a vote of thanks on behalf of the members.

The first annual conference of the Rugby branch of the Association was held on October 10th, when nearly 50 members of the branch were entertained to luncheon and tea by the British Thomson-Houston Co., Ltd., and the afternoon was spent in visiting the Rugby works of that firm.

On October 23rd Mr. Francis, of the British Electrical Development Association, lectured before the Manchester and Salford District Branch of the E.A.W. on "Modern Tendencies in Architecture and Lighting Design."

At a meeting of the Cardiff branch of the Association on October 15th, Mrs. J. Tyler, the retiring hon. secretary of the branch, was presented with a cheque on behalf of the members. Mrs. Tyler, in acknowledging the gift, commented on the rather tiring announcements which one read as to what the American housewife did in the home. There were no keener housewives in the world than the women of Great Britain.

Royal Naval Engineers' Annual Dinner.

The Royal Naval Divisional Engineers are holding their annual dinner at the London Tavern, Fenchurch Street, E.C., on Friday, November 15th, at 6.30 p.m. for 7. (No evening dress.) Tickets, price 5s. 6d., may be obtained from Mr. F. W. Davey, 14, Victoria Street, S.W.1. and Mr. Eric Wattern, St. Stephen's House, Westminster, S.W.1, or at the restaurant.

Leicester Textile Exhibition.

The annual Textile Machinery and Accessories Exhibition, held at Leicester from October 16th to 26th, presented few, if any, exceptionally new features from an electrical viewpoint. In the past twelve months, however, big progress has been made in the use of electrical drives for hosiery and knitting machines, and the use of the positive individual electrical drive is certainly fully appreciated by machine builders, it being only a matter of time before it becomes generally adopted by the trade as a whole. The power plant for the exhibition consisted of a rotary convertor, taking 500 volts d.c. and giving an output of 400-volt, 3-phase a.c. The Midland Dynamo Co., Ltd., supplied most of the motors for driving the machinery, mostly fractional-horse-power individual drives used on sewing machines, linking machines, and small knitting machines, &c. Group drives for the larger knitting machines are chiefly by motors of from two to five h.p., and the firm claims this method of driving to be very much cheaper than any other. Perhaps the most interesting drive is that applied to sewing-machine benches, which takes up no otherwise useful room, and fits under the middle section of the bench, driving by a silent chain running in an oil bath. Special units also using chain drives are fitted between the machines, thereby occupying minimum space. What appeals to the manufacturers of hosiery is the fact that the electric drive can be started without loss of time first thing in the morning when the machines are cold. Reduction gears with automatic features giving a ratio of 45 to 1 are being used.

In addition to its stand devoted to textile winding machines, the Universal Winding Co. had a stand displaying its special coil-winding machines. In the case of the No. 96 winder for self-supporting coils of the spool-wind type, such as meter coils or field coils, the supporting element is obtained by the interweaving of cotton strands between the wire turns and layers, which, in addition to furnishing the required binder, act as an insulating agent, especially between the end turns of each layer, at which point the cushion of cotton is increased to the maximum to take into account the increased potential. The cotton is built up into flanges and, as the complete mass readily absorbs impregnating solu-

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tions, the finished coil is thoroughly armoured throughout, and prevents any damage to the windings. Besides the standard wire compensating device, the machine is equipped with an electrical stop motion which stops the winding spindle immediately breaks or other interruptions occur in the cotton supply; the spindle is also automatically stopped when breaks occur in the wire supply, and there is a counter which records the number of turns. No. 97 machine is for the production of self-supporting spool-wind coils, with paper insulation of high di-electric strength between the wire layers. The machine has two spindles and four coils of the same specification are turned out at a time. The machine will handle wires ranging from No. 29 to 44 (B. & S. gauge) in size, and winds coils either round or rectangular up to two inches diameter. The layers of wire are recorded by means of an adjustable counter, which can be set for any required number of layers up to 100, and when the set number is reached the winding automatically stops by means of a release. Machine No. 102 is a winder for the production of small spool-wound coils, such as telephone coils, which do not require insulation. It is built in units of three or six spindles, governed by a common traverse, but apart from this, operating independently. Each spindle has a special measuring device which can be set to any number of turns up to 90. Two motors for driving centrifugal rayon spinning pots were shown by Mr. R. H. Donald. One is a new model brought out by the A.E.G. Electrical Co., which has previously been responsible for a very successful type. The new motor is on similar lines to its predecessors, but is of cheaper quality. It, however, is apparently of robust construction, and mass production is given as the reason for its low price. The "Tornado" motor appears for the first time in this country, and is also on similar lines to other well-known makes. This has, it is claimed, an especially low power consumption, and is entirely enclosed in bakelite. It is, however, a considerably higher-priced model than the A.E.G. motor mentioned above. It is made by Messrs. E. Blaschke, whose special "Kuma" brake switch for rayon spinning motors was also shown. It is made throughout in bakelite and has the advantage of lightness. Among other exhibitors may be mentioned Monel-Weir, Ltd., and W. & T. Avery, Ltd.

Ships' Auxiliary Turbo-Electric Drive.

A system of auxiliary turbo-electric drive for vessels with steam reciprocating engines has recently been installed in the Ellerman liner, *City of Hong Kong*. The system has been developed by the Metropolitan-Vickers Electrical Co., Ltd., in co-operation with Mr. Hinchliffe, superintendent engineer of Ellerman Lines, Ltd., and the alterations to the vessel have been carried out by Workman Clark (1928), Ltd., of Belfast. It is the first application of auxiliary turbo-electric drive to ship propulsion, and the trials of the vessel with her new machinery were carried out in the Irish Sea on October 10th and 11th, when an exhaustive investigation of the performance of the machinery over a wide range of operating conditions was made. The economic gains to be expected from this type of installation were amply demonstrated, but interest centred mainly upon the peculiar advantages of the system, in which an exceptionally high and controllable degree of flexibility between the turbine and propeller shaft is obtained. It was shown that, even at reduced engine power, a large turbine output was still obtainable. Included amongst the exhaustive tests was a series of full-speed and low-speed reversals of the reciprocating engine and electrical machinery together. The simplicity with which the control of this new system is carried out received particularly favourable comment. The motor portion of the equipment is mounted on a jack shaft fitted directly into the tail shaft.

Fatality.

An inquest was held at Norton, Stockton, on October 24th, on the body of Thomas Henry Larkman, who received a fatal electric shock at the Billingham Synthetic Works of Imperial Chemicals, Ltd. Evidence was given to the effect that deceased and two other men dismantled a heavy cog wheel connected with a centrifugal tank. They carried it away and had to pass an electric cable with a pressure of 230 V leading to a heater. They lifted this up, but on returning with a new wheel forgot about the cable, and as the wheel was rolled over it, the cogs cut the insulation cover. All three were rendered unconscious and efforts to revive Larkman failed. The Coroner, in recording a verdict of "Death by accidental electrocution," said it was an extraordinary mishap, with blame attached to no one.

E.P.E.A. Annual Dinner.

In connection with the note which appeared in the ELECTRICAL REVIEW for October 25th, p. 721, Mr. T. D. Martin has pointed out a typographical error in the summary of his speech. The efficiency of production at the consumers' terminals should, of course, have been given as 17 per cent. Mr. Martin's actual words were:—

"A pound of coal—a mere handful—has anything from ten to fourteen thousand British thermal units of heat in it, and what do we get at the electric cooker, or the toaster? Dare I say, at the very best, 17 per cent? That is 83 per cent. wasted. Now ask yourselves the question: Are we much improved or removed from those Chinese who burnt houses to roast pigs? However, to return to our essay, we read that in the progress of time a sage arose who invented a rude form of gridiron, and showed it was no longer necessary to burn houses down to roast pigs. To-day we have not a gridiron, but we have what is generally known as a "grid" being put up by the Central Electricity Board, and we hope it will be able to show the marked improvement in the conservation of energy as was shown by the Chinese who invented the gridiron."

Interesting Radio Demonstration.

On October 24th, at 8 p.m., at Jack Straw's Castle Hotel, Hampstead Heath, Captain P. P. Eckersley, until recently chief engineer of the B.B.C., demonstrated that the new regional scheme now in operation at Brookman's Park does not preclude listeners-in from enjoying distant foreign programmes, provided a reasonably good, but not necessarily expensive, set is used. Jack Straw's Castle was chosen because it is within six miles of Brookman's Park, and Hampstead has been stated to be a difficult area for reception, even when 2 LO was operated from Oxford Street. Captain P. P. Eckersley, under the auspices of the Marconiphone Co., demonstrated a Marconiphone model 47 four-valve receiver, and explained that it was only in that area immediately surrounding the station that trouble was experienced, and, while sympathising with those in that district, he did not think that their plight was so serious as was at first supposed. It was merely a question of adapting receiving technique to transmitting conditions. In many cases an effective remedy was a reduction in length of the aerial; with any reasonably efficient receiver that would greatly improve selectivity without causing too serious a loss in range. When the set was out of date the improved results obtainable from a modern receiver would seem to justify the change to a new instrument. The stations working on the medium wave-band, however, were always susceptible to interference and fading, and even without Brookman's Park it was only on the long waves that one could obtain reliable reception under service conditions. Reception of long-wave stations presented little difficulty on a modern circuit. If it were the aim of the broadcasting authority to enable everyone to listen to the foreign transmissions, the best thing would be to shut down altogether.

Appointments Vacant.

Temporary plumber cable-jointers for Farnworth Urban District Council. Meter tester and repairer for Southampton Corporation. Cable-jointer for the Calcutta Electric Supply Corporation, Ltd. Station engineer for the Government of Nigeria. Shift engineer for the Borough of Darwen Electricity Department. Assistant mains engineer for Winchester City Council. Chief salesman for Heston and Isleworth Urban District Council's electricity showrooms. (See our advertisement pages to-day.)

Faraday House Old Students' Association.

On Friday last, the 21st annual dinner of the Association was held at the Savoy Hotel, Dr. Alexander Russell, F.R.S., president, taking the chair. The gathering was stated to be the largest meeting of old students yet held, some 300 members and guests being present, including nine past presidents of the Institution of Electrical Engineers. The health of Faraday House and its old students was proposed by Dr. S. Z. de Ferranti, F.R.S., in the absence of Sir Hugo Hirst, Bart., through illness. Dr. de Ferranti said that, since the foundation of the college in 1890, 2,000 students had received their technical training there, and 1,000 of them were members of the Association; 360 students were now in attendance. In support of his belief that one could not have too much technical knowledge if one could only use it well, the speaker related how his lack of theoretical training, compared with modern ideas—he had had one year at London University—had prevented his working out to their logical conclusions his early experiments which, properly exploited, might have led him to the invention of the induction motor and the tungsten lamp.

Dr. Russell, in response, referred to the fact that the sons of pioneers were showing great promise. He also noted that six old Faradians were present at the I.E.E. Council meeting the evening before. Posts had been obtained by 170 ex-students during the past year.

Mr. G. W. Partridge, proposed "The Guests," suggested that the most satisfactory way of obtaining young engineers was to apply to Faraday House. He expressed his confidence that a perfectly practicable method had been devised for dealing with the problem of sulphur fumes from generating stations. Response was made by Sir Philip Dawson, M.P., in optimistic vein regarding the future of electricity supply, with particular reference to its extended use on railways, and by Sir J. Fortescue Flannery, Bart., with a reference to the essential part to be played by electricity in traction, aviation, and marine propulsion. Lieut. Col. J. T. C. Moore-Brabazon, M.C., also responded, and urged British engineers to assert their just title to pre-eminence. Thus they might enter a claim for the unit of candle power to be known as the "Swan"; also, why should not the unit of action, the quantum, be referred to as the "Russell."

Dr. W. H. Eccles, F.R.S., proposed the health of the chairman, glimpses of whose erudition and dry humour could be obtained from a perusal of the *Faraday House Journal*.

Dr. Russell, in a brief reply, referred to his 40 years at Faraday House, from the time when it was called by the cumbrous title of the Electrical Standardisation, Testing, and Training Institution.

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Aluminium for Electrical Purposes.

According to the *Revue de l'Aluminium et de ses Applications*, of Paris, aluminium bars have been adopted for the l.p. wiring at the electric power station at Issy-les-Moulineaux of the Compagnie Parisienne de Distribution d'Electricité, and at the Vendome sub-station of the same company. Moreover, all the connections at the 3,000-kW sub-station of the French Office National des Recherches Scientifiques et Industrielles near Paris are made with aluminium bars.

Manchester Electrical Engineers' Dance.

The annual Manchester Electrical Engineers' Dance will be held on December 13th, at the Midland Hotel, Manchester. Tickets, inclusive of dinner, at one guinea each, can be obtained from Mr. C. D. Taite (hon. secretary), 196, Deansgate, Manchester, Mr. J. Harcourt-Williams (hon. treasurer), King's House, King Street West, Manchester, or any member of the general committee. Special arrangements have been made with the Midland Hotel to accommodate any guest desiring to stay the night, at a reduced price for bed and breakfast.

Electrical Power Engineers' Association.

KENT SECTION.—The tenth annual dinner of the Section will be held at the Royal Star Hotel, Maidstone, on Saturday, November 23rd, at 6 for 6.30 p.m.

Lifeboat Telephones.

The first lifeboat to be fitted with a wireless telephone has just been formally handed over to the inhabitants of Stornoway on behalf of the Royal National Lifeboat Institution. The new boat, which superseded an old pulling and sailing craft, is one of the latest motor models, 51 feet long, with eight watertight compartments. The two 60-h.p. engines are entirely enclosed and watertight, and will continue to function even should the engine room be flooded, when they could be controlled from the deck. In addition to the usual equipment, there is a powerful line-throwing gun, which, with the addition of the telephone, will make the new boat the most effective life-saving machine on the coasts of Great Britain.

The Manchester Electro-Harmonic Society.

The Manchester Electro-Harmonic Society opened its eleventh season on October 18th. Once again the main hall of the "Manchester Limited" Restaurant, Royal Exchange Building, has been engaged for the series of concerts, and the applications for membership to date promise a still further increase in the number of members. The Society is again fortunate in having Mr. J. A. Robertson as president, and he occupied the chair on the opening night, when the "Duds" Concert Party provided the entertainment. An invitation is extended to all members of the electrical and allied industries in the Manchester area to join the Society, and thus take advantage of the social intercourse which these functions provide. The December meeting will be a special one, in that the Liverpool Electro-Harmonic Society will again make a visit. A ladies' night has been arranged for February 1st, as the experience of the last two proved their popularity and success. It is intended this year to recognise in some tangible form the long and efficient service rendered by the hon. secretary, Mr. C. E. Leak, and the hon. treasurer, Mr. L. H. Marlon. A sub-committee has been appointed to deal with this, and it is hoped to make these presentations before the Christmas recess. Once again the balance sheet shows a good surplus on the year's working.

A Cable-laying Vehicle.

The Société Française des Lignes Télégraphiques et Téléphoniques, which has laid many of the telephone cables in France, notably the line between Paris and Strasburg, has recently secured a patent in respect of an improved cable unwinding and laying vehicle. The object of the arrangement is to secure that the cable shall be unwound from its drum in a single direction, so reducing the risk of damage to the cable in the laying operation. To this end the drum-carrying platform is mounted on a vertical spindle so that it, together with the drum, can be turned to any desired angle. The vehicle is also fitted with an adjustable cable-delivering conduit which also assists in preventing any twisting of the cable in the unwinding operation.

Institution Notes.

Institution of Electrical Engineers.

INFORMAL MEETING.—Mr. R. Borlase Matthews is to open a discussion at the informal meeting of the Institution on November 4th, at 7 p.m., on "Paris and the Pyrenees: Notes on some of the Technical Features of the 1929 Visit." In addition to ordinary lantern slides, he will also show 16 mm. kinematograph films of pictures taken during the visit. The projectors for this type of film have been very considerably improved and are suitable for showing to audiences of about two hundred. Also he will show photographs by means of an epidiascope, which is a novelty so far as the Institution is concerned. The photographs and lantern slides were taken by various members of the party and some of the films were taken by Mr. Bertram Thomas and the remainder by Mr. Matthews. The suggestion of the ex-president, Col. K. Edgcumbe, that there should be a sort of re-union of those who took part in the summer visit of the Institution was an excellent one. It was taken up by Mr. H. T. Young and very sympathetically considered by the Informal Meetings Section, which requested Mr. Matthews to open the discussion.

SECTION PROGRAMMES.—The following is the programme of the meetings to be held by the Wireless and Meter and Instrument Sections during the first half of the coming season:—

1929.

WIRELESS SECTION.

November 6th.—Inaugural address by the chairman, Captain C. E. Kennedy-Purves, R.N.

December 4th.—"Naval and Wireless Telegraphy Communications," Mr. G. Shearing and Capt. J. W. S. Dorling, R.N.

METER AND INSTRUMENT SECTION.

November 1st.—Inaugural address by the chairman, Mr. E. W. Hill.

December 6th.—"A.c. Potentiometers and their Applications," Dr. C. V. Drysdale.

1930.

January 6th.—"Instrument Transformers," Mr. J. G. Wellings and Mr. C. G. Mayo.

SCOTTISH CENTRE.—The annual dinner will be held on November 26th at the Grosvenor Restaurant, Gordon Street, Glasgow. Reception 6.30 p.m. Dinner 7 p.m. This will again be a ladies' evening, and there will be dancing and cards after dinner.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

The public service of Leeds will lose a valuable worker by the retirement from the City Council of Alderman HUGH LUPTON, who has long served the city in many capacities and particularly in connection with the Electricity Department. During his chairmanship the Leeds Electricity Department made rapid strides. He was for some years chairman of the Yorkshire District Industrial Council for the Electricity Supply Industry.

Mr. H. W. LAING, manager of Lytham-St. Annes Tramway Department, has tendered his resignation. He has had charge of the tramways in Lytham-St. Annes for 23 years, for he was manager for the company which owned the system before the Corporation took it over nine years ago.

The chairman of the North-Western Centre of the Institution of Electrical Engineers, Mr. T. E. HERBERT, delivered his address on Tuesday last. Mr. Herbert, whose portrait appears herewith, is a Post Office engineer; he joined the service in 1896 as a sub-engineer, and was responsible for the Manchester trunk telephone exchange, which at that time was the largest in the kingdom. In 1906 he was appointed sectional engineer at Sheffield, and in 1919 he became assistant superintending engineer of the Scotland West District. In the following year he was transferred to Manchester as assistant superintending engineer of the South Lancashire District, a position which he still holds. In the closing years of last century he was a lecturer in telegraphy and telephony at the Municipal College of Technology, Manchester. Since 1921 Mr. Herbert has been vice-chairman of the South Lancashire Section of the Institu-

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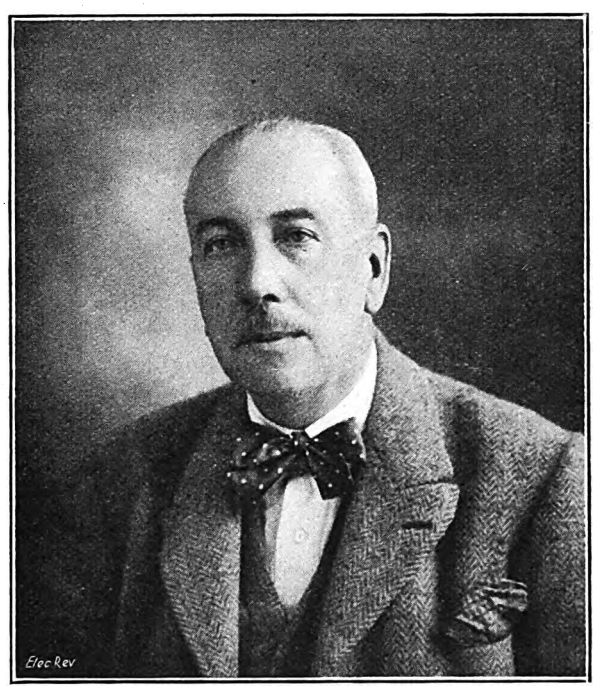
tion of Post Office Engineers. His connection with the I.E.E. commenced in 1899, when he was elected an associate; he became an associate member in 1900, and member in 1921. He has served on the North-Western Centre Committee since 1925, and was vice-chairman last session. Mr. Herbert has written books on "Telegraphy" and "Telephony"; the fifth



Mr. T. E. Herbert.
Chairman of the North-Western Centre of the I.E.E.

edition of the former (11th impression) is at present in the press. In conjunction with Mr. R. G. de Wardt, he has written "The Arithmetic of Telegraph and Telephony."

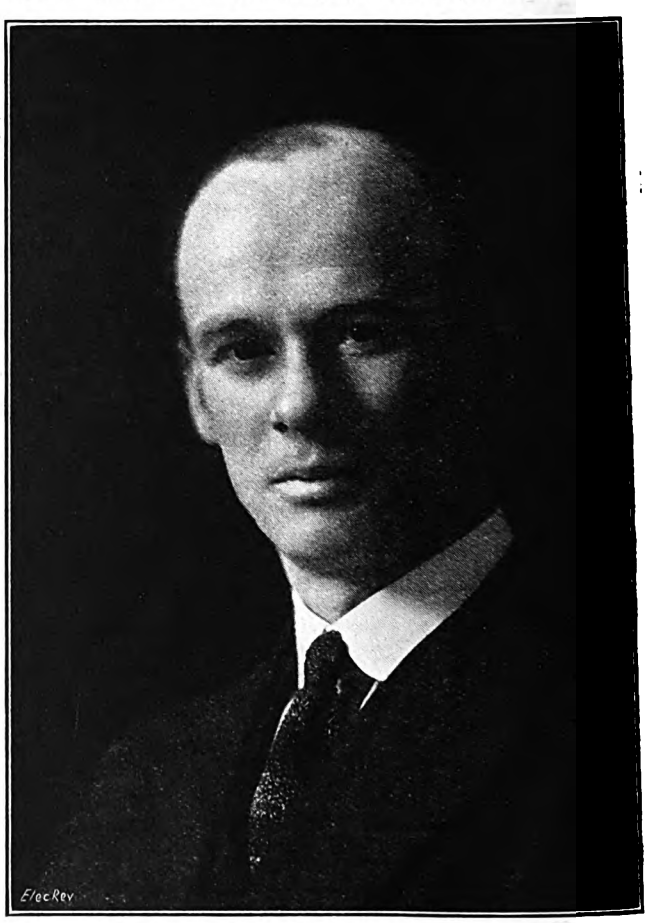
The new chairman of the North Midland Centre of the Institution is Mr. THOMAS ROLES, whose portrait appears herewith. Mr. Roles was born at Brighton in 1875,

Lafayette] *[Manchester.*

Mr. T. Roles.
Chairman of the North-Midland Centre of the I.E.E.

and received his education in electrical and mechanical engineering at the Brighton Technical School. His first engagement was at the Brighton branch of the Electrical Supplies & Fittings Co., and in 1892 he entered the service of Messrs. Crompton & Co., being employed on work in connection with the erection of the plant of the Hove Electric Lighting Co. In March, 1895, he became assistant electrical engineer at Aberdeen, but in order to gain practical experience of h.p. a.c. working he obtained a position as draughtsman in the Leicester Corporation Electricity Department in 1897, and after a short period he was promoted to the position of mains engineer. In 1900, he secured the appointment of generating engineer at the Poplar Electricity Works, and in 1904 he left Poplar to become chief assistant electrical engineer to Bradford Corporation. In 1907 he succeeded to the position of city electrical engineer and manager at Bradford, where he has been responsible for the installation of the whole of the three-phase generating plant, which, when the scheme of extensions now in hand is completed, will have a capacity of 105,000 kW. Included in the scheme of extensions is a large boiler designed for a working pressure of 1,100 lb. per sq. in. and a turbo-alternator of 2,500-kW capacity to operate at that pressure. The capital expenditure on the Bradford undertaking now exceeds £3,250,000, of which over £2,500,000 has been expended since Mr. Roles became connected with it. He has also paid considerable attention to the development of the business side of the undertaking, including the extension of the motor-hiring department, the institution of schemes for the hiring of electric cookers, &c., and the hire-purchase of electrical installations and various domestic appliances, the opening of showrooms, &c. He has greatly developed electrical driving in the textile mills of the city, and also the use of electricity for heating and cooking purposes. He was chairman of the Yorkshire Local Section (now the North-Midland Centre) of the I.E.E. in 1914-15 and is again chairman of this Centre for the current year; he was a member of the Council of the I.E.E. from 1921 to 1924, President of the Incorporated Municipal Electrical Association in 1919-1920, and at present represents the Mid-East England Centre on the Council of that Association.

We reproduce herewith a portrait of Mr. G. MORGAN, this session's chairman of the Scottish Centre of the Institution. Mr. Morgan was educated at the Glasgow High School and Royal Technical College, and later at the Durham College of Science, Newcastle-upon-Tyne. He served his engineering apprenticeship with Messrs. Ross and Duncan, Govan, and Messrs. Clarke, Chapman & Co., Ltd. He joined the Glasgow Corporation Electricity Department about 24 years ago as engineer-in-charge, sub-stations. He subsequently became engineer-in-charge, power stations. Then he was successively assistant superintendent of sub-stations, resident engineer at the Port Dundas power station, assistant super-



W. Ralston] **Mr. G. Morgan.** *[Glasgow.*

Chairman of the Scottish Centre of the I.E.E.

intendent of power stations, superintendent of power stations and assistant engineer, the position which he now occupies. During his service with the Glasgow Corporation Mr. Morgan has taken a considerable part in the development of the undertaking. The principal events during this period have been the placing of the Dalmarnock station into commission, its subsequent extensions, and the inauguration of the 20,000-V transmission system.

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Upon the recommendation of its Electricity Committee the Blackburn Corporation has appointed Mr. WILLIAM ARDEN ROYLE, of Sunderland, to succeed Mr. P. P. Wheelwright as borough electrical engineer; there were 40 applicants for the position. Mr. Royle is a native of Manchester, and after being educated at the Southport Technical School and the Manchester College of Technology, he became a pupil with the Southport Electric Lighting Co. His first appointment was as assistant engineer in the Monmouth Corporation electricity undertaking. Later he joined the British Westinghouse Electrical Manufacturing Co., Ltd., as erecting engineer, and upon leaving that company took up a similar post with Messrs. Ferranti, Ltd. He went to Sunderland in 1918 as sub-station superintendent, and subsequently held the positions of distribution engineer, assistant engineer and assistant manager, a post which he now relinquishes. Mr. Royle is 39 years of age.

We regret to learn that Mr. P. P. Wheelwright has been ill and confined to bed, but is now reasonably well and about again. Since leaving Blackburn Mr. Wheelwright, in addition to receiving some personal gifts from members of his staff, has been presented with a handsome gold cigarette case from the members of the staff and workmen of the Blackburn Electricity Department.

MR. H. K. BEALE, chairman of the Birmingham Electric Supply Committee, has been re-elected to the City Council without opposition.

Graham Amplion, Ltd., has appointed Mr. W. G. DAVIES, sales director, joint managing director of the company.

The *Electrical World* states that Mr. ERNEST V. PANNEL, who has been technical adviser in New York to the British Aluminium Co., Ltd., will in the near future take over the management of the London Aluminium Co., Ltd., Birmingham, England, a manufacturing organisation specialising in stampings and other fabricated forms of aluminium and light alloys.

MR. R. H. HARRAL, senior assistant on the mains staff of the Yorkshire Electric Power Company, has been appointed mains superintendent to the Blackburn Electricity Department.

Mr. T. B. DRUMMOND, chief draughtsman in the Electricity Supply Department of the Liverpool Corporation, who ordinarily should retire on superannuation at the end of this year, having attained the age limit, is to continue in the service of the department until December 31st, 1930.

MR. VERNON HOPE, electrical engineer, of Upton Hall, has been re-elected, unopposed, a member of the Macclesfield Town Council.

Miss FREDA M. NAYLER, daughter of Mr. G. F. Nayler, electrical engineer and tramway manager at Nelson, has been awarded the Silver Rose Bowl trophy at the Blackpool musical festival.

A correspondent is anxious to get into touch with Mr. A. H. WOOD, A.M.I.E.E., who some years ago had offices at 28, Victoria Street, S.W.

Mr. J. HERBERT EDWARDS, managing director of the Western Electricity Supply Co., Ltd., and associated companies, who is retiring from active management in favour of other appointments, was recently presented by the staff with a telescope and an illuminated address.

Mr. S. H. FOWLES, borough electrical engineer of Ilkley, has been appointed electrical engineer to the Loughborough Corporation in succession to Mr. G J. Hollyer, who is taking charge of the Torquay undertaking. Mr. Fowles was educated at University College, London, and Armstrong College, Newcastle. After serving with the Scottish Central Power Co. and the Newcastle-upon-Tyne Electric Supply Co., he entered municipal service at Dewsbury and subsequently held positions at Aylesbury and Chesterfield.

Obituary.—MR. J. MORRIS.—We regret to record that the president of the Salford Technical and Engineering Association, Mr. J. Morris, M.I.E.E., passed away on October 24th. Mr. Morris was in his 76th year, and had been president of the Association since its foundation 38 years ago.

MR. A. BAKER.—We regret to learn of the death of Mr. Alfred Baker, formerly general manager to the Birmingham Corporation Tramways and Omnibus Department. He held the position from the time of the municipalisation of the Birmingham electric tramways 26 years ago. He was responsible for the creation and development of the Corporation motor-omnibus service. Mr. Baker started life as a tramway conductor, and before going to Birmingham he was first manager of the Nottingham Tramway Company, and, later, manager of the London County Council Tramways.

Wills.—The late Mr. R. W. KENNARD, who was chairman of the Falkirk Iron Co., Ltd., left £38,452 gross and £18,647 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Regent Radio & Cycle Co., Ltd.—Private company. Registered October 24th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electrical and other instruments and components in connection with wireless telegraphy and telephony, motor cars, cycles, &c. The first directors are: S. Kremner, The Quest, Okeover Road, Salford, wireless dealer (director of Samdon Wireless Co., Ltd., and Radio Parts, Ltd.); I. Kremner, 10, Bignon Street, Cheetham, Manchester, wireless salesman. Registered office: 41, John Dalton Street, Manchester.

Hartley Main Power Co., Ltd.—Registered as a private company October 24th. Nominal capital, £100 in £1 shares. Objects: To carry on the business of an electric power and light company in all its branches and to generate, accumulate, distribute and supply electricity for all purposes for the use or benefit of the Hartley Main Collieries, Ltd. The directors are: Sir T. G. Wrightson, Bt., G. Hurst, P.C. Chichester, W. W. Burdon, W. I. Wrightson, addresses not stated; G. C. Pollard, Seaton Delaval Hall, Seaton Delaval (director Hartley Main Collieries, Ltd.); C. Irwin, 41, Percy Park Road, Tynemouth (director Hartley Main Collieries, Ltd.). Secretary: J. T. Roberts, Exchange Buildings, Quayside, Newcastle-on-Tyne.

A. E. Collier & Co., Ltd.—Private company. Registered October 25th. Capital £100 in £1 shares. Objects: To acquire the business of electricians, mechanics and radio and wireless engineers, carried on in Southport as Collier & Illingworth, Ltd. The first directors are: A. E. Collier, engineer, and Mrs. C. G. Collier, 4, Chambres Road North, Southport (both permanent). Solicitor: R. Hodge, 18, Hoghton Street, Southport.

Dean & Gosling, Ltd.—Private company. Registered October 22nd. Capital £1,000 in £1 shares (600 ordinary and 400 10 per cent. cumulative participating preference). Objects: To acquire the business of electrical, hydraulic, and mechanical engineers and contractors, manufacturers and merchants carried on by A. P. Dean, A. R. Gosling and F. T. Gosling at Colchester. The first directors are: F. T. Gosling, 8, Victoria Road, Colchester; A. P. Dean, 19, Wellesley Road, Colchester, engineer; A. R. Gosling, 8, Victoria Road, Colchester, engineer. Qualification, £100. Secretary: A. R. Gosling. Registered office: 14a, Hospital Road, Colchester.

Great Northern Telegraph Company's Holding Co.—Particulars of this company were filed on September 30th, pursuant to Section 274 of the Companies (Consolidation) Act. Capital, kr. 8,100,000 (£450,000) in 150,000 shares of kr. 54 (£3) each. The share capital may be increased to kr. 16,200,000 (£900,000).—The company was incorporated in Denmark on July 10th, 1928, to acquire and hold, and if deemed expedient, sell a number of shares in the Great Northern Telegraph Co., Ltd., and to exercise all rights and powers attached to the ownership of these shares. The registered office is in Copenhagen. The British address is at 5-7, St. Helen's Place, E.C. O. E. Neilsen, of "Heathercourt," Dollis Avenue, N.3, is authorised to accept service of process and notices on behalf of the company. The directors are:—W. H. O. Weiman (chairman of the Great Northern Telegraph Co., Ltd.); O. C. Scavenius (director of the Great Northern Telegraph Co., Ltd.); and S. Kay (managing director of the Great Northern Telegraph Co., Ltd., &c.), all of Copenhagen; and J. R. Audap, Paris.

Tellus Electric Cleaner Co. (Scotland), Ltd.—Private company. Registered in Edinburgh on October 22nd. Capital, £10,000 in 5,000 ordinary and 5,000 preference shares of £1 each. Objects—To acquire the business formerly carried on by F. Smart and now by J. L. Smart as the Tellus Electric Cleaner Co. The directors are:—L. S. Smart, 93, Hope Street, Glasgow, consulting engineer; G. A. Cook, 107, Bath Street, Glasgow, C.A.; J. L. Smart, "The Pines," Heronsgate, Watford, Herts., export merchant; H. Harper, Jun., 29, Hawkhead Road, Paisley. Secretary: H. Harper. Registered office: 33a, Gordon Street, Glasgow, C.1.

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Official Returns of Electrical Companies.

Sun-Ray Electric Lamp Co., Ltd.—Debenture dated October 9th, 1929, to secure £250, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: S. Nicholson, Old Bank, Frinton-on-Sea.

J. Parmley Graham & Sons, Ltd.—Capital, £5,000 in £1 shares. Return dated April 11th, 1929. 300 shares taken up. £300 paid. Mortgages and charges, nil.

Playford & Son, Ltd.—Capital, £2,000 in £1 shares. Return dated July 29th, 1929. 1,214 shares taken up. £1,214 paid. Mortgages and charges £500.

Camborne Electricity Supply Co., Ltd.—Capital, £20,000 in £1 shares. Return dated May 9th, 1929. All shares taken up. £20,000 paid. Mortgages and charges, nil.

Robin Electric Lamp Co., Ltd.—Capital, £75,000 in £1 shares. Return dated December 31st, 1928 (filed July 18th, 1929). 60,352 shares taken up. £10,300 paid. £50,000 considered as paid. £52 in arrears. Mortgages and charges, nil.

Veritys, Ltd.—Capital, £196,000 in 7,000 5 per cent. preference and 7,000 6 per cent. preference shares of £10 each, 7,000 preferred ordinary shares of £7 10s. each, and 70,000 deferred ordinary shares of 1s. each. Return dated August 7th, 1929. All shares taken up. £137,701 10s. paid on 4,670 5 per cent. preference, 7,000 6 per cent. preference, 2,800 preferred ordinary, and 30 deferred ordinary shares. £58,298 10s. considered as paid on 2,330 5 per cent. preference, 4,200 preferred ordinary, and 69,970 ordinary shares. Mortgages and charges, £96,846 19s. 1d.

Edmundson's Electricity Corporation, Ltd.—Capital, £3,150,000 in 400,000 7 per cent. cum. preference and 2,750,000 ordinary shares of £1 each. Return dated July 19th, 1929. 400,000 preference and 2,250,000 ordinary shares taken up. £950,400 paid (being £1 per share on 450,400 ordinary and 400,000 preference, and 10s. per share on 200,000 ordinary shares). £1,599,600 considered as paid on 1,599,600 ordinary shares. Mortgages and charges, nil.

Chelsea Electricity Supply Co., Ltd.—Capital, £450,000 in 30,000 preference and 420,000 ordinary shares of £1 each. Return dated April 25th, 1929. 30,000 preference and 395,488 ordinary shares taken up. £218,850 paid on 30,000 preference and 188,850 ordinary shares. £206,638 considered as paid on 206,638 ordinary shares. Mortgages and charges, £72,380. A return of allotments made up to May 23rd, 1929, shows a further 8,989 ordinary shares allotted, payable in cash, and fully called up.

Provincial Tramways Co., Ltd.—Capital, £275,440 in 10,000 preference shares of £10 each and 175,440 ordinary shares of £1 each. Return dated May 29th, 1929. 10,000 preference and 124,560 ordinary shares taken up. £162,700 paid on 3,814 preference and 124,560 ordinary shares. 61,860 considered as paid on 6,186 preference shares. Mortgages and charges, £80,140.

Central Electric Supply Co., Ltd.—Capital, £350,000 in £5 shares. Return dated March 5th, 1929. 65,000 shares taken up. £100,000 paid. £225,000 considered as paid. Mortgages and charges, £384,810.

Burwood (Concessionaires), Ltd.—G. E. McCanlis, Oxford House, 9-15, Oxford Street, W., ceased to act as receiver and manager on October 10th, 1929.

C.C.A. (Central Cables and Accessories), Ltd.—Capital, £3,000 in £1 shares. Return dated May 28th, 1929. All shares taken up. £3,000 paid. Mortgages and charges, nil.

H. T. Bourn, Ltd.—Capital, £800 in £1 shares. Return dated December 18th, 1928 (filed May 24th, 1929). 680 shares taken up. £680 paid. Mortgages and charges, nil.

Warren Brothers (Middlesbrough), Ltd.—Debenture dated October 10th, 1929, to secure £2,000 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Mrs. L. Lucas, 27, Clifton Avenue, West Hartlepool.

Young, Osmond & Young, Ltd.—Deposit on September 28th, 1929, of deeds of leasehold property at Welwyn Garden City, to secure all moneys due or to become due from the company to Lloyd's Bank, Ltd., not exceeding £7,000.

Foster & Pullen, Ltd.—Capital, £5,000 in £1 shares. Return dated September 1st, 1929. 4,626 shares taken up. £2,626 paid. £2,000 considered as paid. Mortgages and charges, nil.

Asbestos and Electrical Fittings Co., Ltd.—Capital, £39,994 in £1 shares. Return dated May 13th, 1929. 10,006 shares taken up. £615 paid. £9,391 considered as paid. Mortgages and charges, nil.

Dyer & Young, Ltd.—Capital, £10,000 in 5,000 preference and 5,000 ordinary shares of £1 each. Return dated July 5th, 1929. 3,035 preference and 3,250 ordinary shares taken up. £3,035 paid. £3,250 considered as paid. Mortgages and charges, nil.

Ceag, Ltd.—Capital, £1,000 in £1 shares. Return dated June 10th, 1929. All shares taken up. £1,000 paid. Mortgages and charges, nil.

Highfield Electrical Co., Ltd.—Capital, £15,000 in 2,500 preference and 12,500 ordinary shares of £1 each. Return dated September 23rd, 1929. 8,500 shares taken up. £3,500 paid. £5,000 considered as paid. Mortgages and charges, £6,500 debentures to bankers.

Gosport and Alverstoke Electric Lighting Co., Ltd.—Capital, £35,000 in £10 shares. Return dated May 29th, 1929. 2,500 shares taken up. £25,000 paid. Mortgages and charges, nil.

Eastern Telegraph Co., Ltd.—Capital, £7,000,000 in £2,000,000 preference stock and £5,000,000 ordinary stock. Return dated June 12th, 1929. All stock issued and fully paid up in cash. Mortgages and charges, £2,000,000.

County Electrical Co. (Pendleton), Ltd.—Capital, £2,000 in £1 shares. Return dated June 11th, 1929. 1,000 shares taken up. £1,000 paid. Mortgages and charges, nil.

Contal Radio, Ltd. (formerly Continental Radio Import Co., Ltd.).—Capital, £1,000 in £1 shares. Return dated February 14th (filed April 17th), 1929. 510 shares taken up. £510 paid. Mortgages and charges, £500.

John Adams, Ltd.—Capital, £7,000 in 6,000 preference and 1,000 ordinary shares of £1 each. Return dated June 4th, 1929. 2,500 preference and 300 ordinary shares taken up. £2,800 paid. Mortgages and charges, nil.

City Notes.

Electramonic (Foreign Rights), Ltd.

Mr. A. Jerrold-Nathan, who presided at the first annual general meeting of this company last week, said that he had been appointed chairman of the parent company upon the resignation of Sir Philip Dawson, and he became chairman of the Foreign Rights Company in a similar manner. He had signed the report which was before the meeting, but had he seen certain items in it he would not have signed it. The company was not only at a standstill, as the outcome of the position of the parent company, but there was a danger of the small remainder of the original capital melting away altogether. He understood that the shareholders were desirous of getting rid of Mr. E. B. Tredwin, another director, and himself. He also believed that the majority of the shareholders present were the nominees of the holders of a lien on the company's shares. If those holders put in their own nominees as directors the position of the company would not be improved. Upon the conclusion of Mr. Jerrold-Nathan's speech, Mr. W. H. Sayers, joint managing director, was elected to the chair, and subsequently Messrs. Jerrold-Nathan and Tredwin announced their resignation from the board, and Mr. I. E. Smullian was elected a director.

Atlas Light and Power Co., Ltd.

The profit for the year ended March 31st last was £314,683, as compared with £300,907 for 1927-28. A balance of £35,756, brought forward, is added, making £350,439. After meeting debenture interest, debenture and share redemption allocations, and preference dividend, it is proposed to pay a final ordinary dividend of 3 per cent., making 5 per cent. for the year (as last year); £39,428 is carried forward. The report states that the sale of the company's Argentine properties to the American & Foreign Power Co. has been completed. The company still retains an interest in the Montevideo electric traction undertakings, but apart from that it is a general investment trust company, and it is therefore proposed to alter the company's title to "Atlas Electric & General Trust, Ltd." The meeting was held on Wednesday last.

Official Notice *re* Companies.

The names of the undermentioned companies will be struck off the Register, at the expiration of three months, unless cause is shown to the contrary:—

Electric Fans, Ltd.
Hertz Radio Corporation, Ltd.
Local Electric Supplies Co., Ltd.
Metropolitan Electrical Contractors, Ltd.
Westfield Wireless, Ltd.
Wireless Novelties, Ltd.

American Telephone and Telegraph Co.

During the nine months ended September 30th last, the gross earnings were $199,960,370, as compared with $171,724,990 in the corresponding period of 1928. The net earnings rose from $120,911,236 to $140,547,394. After the deduction of interest ($19,720,460, against $16,393,849) and dividends ($86,648,958, against $76,542,741), there is a surplus of $34,177,976 ($27,974,640).

Western Union Telegraph Co.

The report for the nine months ended September 30th, 1929, shows a gross revenue of $111,120,485, as compared with $102,852,646 in the corresponding period of the preceding year. After deducting interest on bonded debt there was a net income of $11,519,175, as against $11,231,366.

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Stock Exchange Notices.

Dealings in the following have been allowed by the Committee under Rule 159:—

Quebec Power Co.—50,290 new common shares of no par value issued at $50 per share fully paid, and fractional warrants (to bearer).

Application has been made to the Committee to allow the following to be officially quoted:—

London Power Co., Ltd.—£3,000,000 5 per cent. debenture stock.

Chloride Electrical Storage Co., Ltd.

The directors have declared an interim dividend of 10 per cent. actual, free of tax, on the "A" and "B" shares, as compared with 5 per cent., free of tax, paid on the old ordinary shares last year.

Brampton Bros., Ltd.

Out of a net profit of £15,697, plus £14,788 brought forward, the directors are paying a dividend of 7½ per cent. for the past year.

Ever-Ready Co. (Great Britain), Ltd.

The directors have declared an interim dividend of 10 per cent. actual on the ordinary shares. A similar distribution was made last year on a smaller capital.

Adelaide Electric Supply Co., Ltd.

A final ordinary dividend of 6 per cent. is proposed, making 12 per cent., free of tax, for the year ended August 31st last.

United River Plate Telephone Co., Ltd.

An interim dividend of 3 per cent., free of tax, has been declared on the ordinary shares, as last year.

Calcutta Tramways Co., Ltd.

The directors have declared an interim dividend of 4½d. per share, free of tax, on the ordinary shares.

Glenfield & Kennedy, Ltd.

The interim ordinary dividend is again 4 per cent. actual.

Swiss Companies.

Brown, Boveri & Co., Baden.—The capital of this company is being increased from 39,200,000 fr. to 47,640,000 fr. by the issue of 70 fr. shares which will have equal voting rights with the existing 350 fr. shares. The *Financial Times* says that this operation seems to be a preventive measure, taken in ample time, to forestall any future movement on the part of foreign interests. At present it is believed that the majority of voting control is in Swiss hands, but the board feels that it is its duty to assure the maintenance of this position.

The *Motor Columbus Société pour Entreprises Electriques*, Baden, reports a net profit of £337,200 for the year ended June 30th last, against £329,787 in the preceding twelve months. A dividend of 10 per cent. is again being paid on the capital of £3,000,000.

The *Elektra, A.G. für Angewandte Elektrizität*, Zurich, which is associated with the Motor-Columbus Company, reports net profits of 1,780,000 fr. for 1928-29, against 920,000 fr. in the preceding year. The dividend on the ordinary shares is 5 per cent.

The *Banque Générale pour L'Industrie Electrique*, Geneva, proposes to pay a dividend of 5 per cent. out of net profits of 1,989,000 fr. for 1928-29, as compared with 1,111,000 fr. No distribution was made in the previous year.

German Companies.

The *Isola Works Co.*, Duren, reports net profits of 96,000 marks and a dividend of 5 per cent. for 1928-29, as compared with net profits of 49,000 marks and no distribution in the previous year.

H. Fuld & Co. (telephone and telegraph works), Frankfort-on-Main, reports net profits of 409,000 marks for the first year of its activity; the dividend is at the rate of 6 per cent.

The *Volta Electricity Works Co.*, Berlin, reports a very small net profit for 1928, which is applied to reducing the deficit brought forward. The turnover in transformers increased, but business in motors kept within moderate limits, and prices were inadequate.

Dutch Company.

The report of *Willem Smit & Co.'s Transformatorenfabriek*, Nijnegen, for the year ended June 30th last, states that the demand for transformers showed a large increase over the previous year, while the price level remained almost constant. The value of the turnover rose by 30 per cent., and the gross profits amounted to 293,000 fl., against 206,000 fl. in 1927-28; the dividend is increased from 7 per cent. to 9 per cent. It is proposed to increase the share capital to cope with expanding business.

French Companies.

The *Société les Isolants Français* has decided to pay a dividend of 20 per cent. for 1928 out of net profits of 371,000 fr.

The *Société des Accumulateurs Electriques Dinin* closed the year ended with June 30th, 1929, with a net profit of 7,056,000 fr., against 6,682,000 fr. in the previous year, when a dividend at the rate of 30 fr. per share was paid.

Stocks and Shares.

TUESDAY EVENING.

THE outstanding feature of the present markets in the Stock Exchange is the extraordinary manner in which prices of American stocks and shares have slumped. There was a panic on the night of Thursday, October 24th, when, in Throgmorton Street, with the rain coming down in sheets, corresponding liquidation broke out in stocks and shares, more particularly those of utilities, and prices gave way under a deluge of selling from New York. So far as London was concerned, the business this side seemed to be more of the supporting order, with people picking up shares at what they considered to be bargain prices, and no particular surprise was felt at the violence of the fall being succeeded by a fairly sharp upward reaction, in the course of which a certain amount of the previous loss was recovered. After a week-end of feverish fluctuations, the selling broke out with renewed severity on the Tuesday in this week. Prices gave way in wholesale fashion, and sympathetic effects of the slump were felt in various markets round the Stock Exchange.

The Ill Wind.

On the other hand, the slump in Americans, instead of proving to be the ill wind which profiteth nobody, served to divert a greater amount of attention than usual to stocks and shares in British industrial and similar undertakings. The prices of many of these had been flat, in consequence of the selling rendered either necessary or precautionary in view of the collapse in prices of Hatry and Horne shares. At the lowered levels, however, and following upon the drop in Americans, speculative attention, which never dies out completely, however much it may be quenched by temporary disappointments, turned to the British shares that had been most severely depressed. Moreover, the driving back of capital from the United States into this country, which is certain to be one result of the American fall, led to a remarkable improvement in the prices of British Government and gilt-edged stocks generally. The movement in the latter had been gathering quiet way for some few weeks past, encouraged by the manner in which foreign exchanges were moving towards normal conditions. When the American slump came, accompanied as it was by a drop in money rates across the Atlantic, the flow of capital into gilt-edged stocks became accelerated, with the sequel that prices are substantially better to-day than they were a month ago.

British Money in New York.

As a matter of interest, gossip may be repeated which says that a well-known insurance company on this side had no less than thirty million pounds sterling lent at call in New York at 10 per cent., and that the bulk of this money has been withdrawn, or is about to be called back, on the decline in American rates of interest. Probably the amount named is grossly exaggerated but the rumour gives an indication of the reason for the strength shown by the gilt-edged market as a whole.

A Few of the Falls.

Brazilian Tractions have fallen 14 points to 53. This was the price in the Stock Exchange Official List at 3.30 p.m. to-day (Tuesday). Two hours later it was 46. The company's preference shares, at 180, are 45 points down. Hydro-Electrics, which were 60 in our last letter, showing a fall of 11½ on the week, further dropped to 53, recovered to 60, and then collapsed to 47. International Holdings are about 7¾, and therefore ¾ down on balance. Montreal Light & Power at 162½ is 5 down. Pennsylvania, at 90, 7½; Power Corporation of Canada, at 97½, 15½. Mexican Light & Power common shares, after their fall of 14 points last week, are 9 lower at 85. Mexico Tramway shares, at 46½, are actually a point to the good. Consolidated Gas of Baltimore went back to 113, Shawinigan Water to 84; Barcelona Traction dropped to 50. The rally which occurred on Monday in this week proved to have no very firm root, and prices fell back sharply on any indication of selling. It is said that financial difficulties have occurred in Amsterdam, Brussels, and in Berlin, the truth of which gossip was possibly nearer the mark than it generally is when such reports are in circulation.

Electricity Supply Shares.

Amongst Home electricity shares, Clyde Valley came into vigorous action, with a rise from £2 to 44s., the jump being explained by reference to the expectation that the company will be bought out by the Birkenhead group—that is to say, the Greater London & Counties Trust—the probable price of purchase being given as £3. People who got into the shares as the price moved up, elected to take their profits, or part of them, at anything like 45s., with the result that the price retreated to 41s. 3d. The new shares are 39s. Yorkshire Electrics drooped to 35s. County of London lost 1s., at 51s. 6d.; Bournemouth & Poole gave way to 62s. Northants keep firm at 52s. Richmond (Surrey) are dull at 43s. 6d., there being a couple of thousand shares on offer at about 44s. Isle of Thanet reacted to 37s. 6d., Egham & Staines to 37s. British Power & Light shares, at 14s. 6d., are 6d. lower.

The Metropolitan Electric Supply Company has called a meeting for November 6th to authorise the creation of half a million

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new ordinary shares of £1 each. This will increase the ordinary share capital to 2¾ million pounds sterling. The price rose to 2⅝ on the expectation that the new shares will be offered at a price involving a bonus to the proprietors.

New Underground Schemes.

The Home Railway stocks are dull, but the liquidation in other markets produced no particular effect amongst the Underground railway stocks. In fact, the gilt-edged securities are strong, and there is active demand for anything which pays from 5 to 5¼ per cent. on the money, provided that the stock carries a gilt-edged flavour. Underground income bonds rose to 106, but lost their gain; the £1 shares are unchanged, also, at 22s. Metropolitans went back to 61½. Beyond this, no net changes have occurred in this group. A programme for Underground Railway development is said to be in contemplation by the Government in connection with the schemes for the relief of unemployment. Over ten million pounds, according to this statement, will be spent upon the improvement of travel facilities in London and suburbs. Mr. J. H. Thomas is expected to refer to these plans when he speaks, early next week, upon the question of employment.

Cables and Wireless.

Cables and Wireless 5½ per cent. preference shows the principal recovery in this particular group. The price has risen to 97, a gain of a point, though actually the market is better, and the buyer who wanted to get on at 98 would probably find difficulty in doing so. The "B" ordinary stock at 50 is 2½ down. American Telephone and Telegraph shares, following upon their drop of 20 points last week, have shed another 50, the price going back to 240, while International Telephone & Telegraph at 90 is 30 points down. Anglo-American Telegraph preferred stock remains dull at 98½, Globe Telegraph and Trust eased off to 23½, the preference shares remaining unchanged at 10⅞. Anglo-Portuguese, after being 2s. 6d., went back to 21s. 3d. Marconi Marines are flat at 2⅛, the recent reduction in the interim dividend leading to uneasiness in regard to what the final dividend may prove to be. The shares have now fallen 10s. from the price at which they stood before the interim announcement was made. Radio shares, which stood at 80 a few weeks back, have been down to 32 within the past few days, rallying later to 41.

Electricity (Supply) Act, 1926.

In view of the interest that is being taken in electricity supply matters at the present time, keen interest centres upon the provisions of the Electricity (Supply) Act, 1926, because not the London companies only, but a number of others now generating and supplying electricity in the United Kingdom are also affected more or less. To take the case of a company owning a generating plant which has been made a selected station: the company may be required by the Board to sell to the Board all electricity generated at the station, at cost. This "cost" means all generating expenses, a proper portion of management and general establishment charges attributable to the station, depreciation and interest ranging from not less than 5 per cent. to not more than 6½ per cent. per annum on all capital expenditure (including working capital on the station.

It will be noticed that the "selected station" company is not limited in profit-earning power with regard to the portion of its undertaking which supplies its own particular customers. Where the power is applied to the grid system of the Government, and is utilised in connection with the general scheme, then the company cannot make more than 6½ per cent. on the capital expenditure already mentioned. The distributing company is in a slightly different position. The Electricity Commissioners may make provision as to the relation between the charges to be made for electricity and the dividends to be paid by the company. Thus it will be observed that the big distributing companies are hardly likely to make any sensible advance in their dividends, but they are not at all unlikely to raise fresh capital, as many of them have already done, through the issue of shares at prices which will give to the proprietors a useful bonus. It is to the latter consideration, rather than to the hope of increasing dividends, that the investor in the shares of such companies turns his expectations.

The Manufacturing Group.

Falls in most of the active stocks and shares in the manufacturing group have occurred in sympathy with the flatness in the American markets Associated Electrical Industries are an exception, rising from 30s. to, at one time, 32s. 6d., before reacting to 31s. 3d., which still leaves them 1s. 3d. up on the week. General Electrics, on the other hand, after being 50s., fell back to 2 5/16. Declines are shown by Henley's, Enfields, Callenders, and British Insulated. The group has been unable to withstand the sentiment prevailing throughout the Stock Exchange as a whole.

Nor is the iron and steel market any better off. Babcock and Wilcox shed a florin, going back to 60s. 6d. The rubber market is flat, because of a drop in the price of the raw produce to a shade under 9d. per pound. To find any stocks and shares which show noticeable strength this week requires stronger illumination than most of the electrical manufacturing companies are able to produce.

Share List of Electrical Companies.

	Nom.	Approx. Dividend. 1927.	1928.	Price Oct. 29 1929.	Rise or fall	Yield p.c.
Home Electricity Companies.						
Bournemouth and Poole	£ 1	15	15	62/-	—1/16	4 16 9
Brompton Ordinary	1	8½	8½	26/-	—	5 7 8
Charing Cross Ordinary	1	8½	8½	26/6	—	5 5 8
do. do. 4½% Pref. ...	1	4½	4½	17/-	—	5 6 0
Chelsea	1	8¼	8¼	25/-	—	5 12 0
City of London	1	10	10	32/-	—	4 7 6
do. do. 6% Pref.... ...	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	2 3/16	+1/16	... ...
County of London	1	7	10	51/6	—1/-	3 18 0
do. do. 6% Pref.... ...	1	6	6	22/6	—	5 6 8
Edmundson's 7% Pref.	1	7	7	24/-	—	5 16 8
Elec. Supply Corporation	1	11	11	52/-	—	4 4 8
Kensington Ordinary	1	8	8	26/-	—	5 7 8
Lancs. Light and Power	1	7½	7½	28/-	—	5 7 2
London Electric	1	8½	9	27/6	—	5 1 10
Metropolitan	1	9	9	47/6	+1/16	3 15 8
do. 4½% Pref.	1	4½	4½	17/-	—	5 6 0
Midland Counties	1	6½	6½	33/-	—	3 18 9
Mid. Elec. Power	1	15	8	34/6	—	4 12 9
Newcastle-on-Tyne Ordinary ...	1	6	6	26/3	—	4 11 5
do. 7% Pref.	1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	10	6	6	11	—	5 9 1
North Met. Elec. 6% Pref.	1	6	6	21/6xd	+6d.	5 11 8
St. James' and Pall Mall	1	8	8	26/6	—	5 5 8
Scottish Power	1	8	8	30/6	—	5 4 3
South London	1	8½	8½	26/6	—	5 5 8
Urban Ordinary	1	7	7	33/3xd	+6d.	3 18 6
Westminster Ordinary	1	8½	8½	25/6	—	5 9 10
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	23/6	—	6 7 8
Yorkshire Elec.	1	8		35/0	—6d.	4 11 6
Home Rails.						
Central London Ord. Assented ...	Stock	4	4	71	—	5 12 8
Metropolitan	„	8	8½	61½	—½	5 18 10
do. District	„	4	5	73	—	6 17 0
Underground Electric	£1	5	7	22/-	—	6 17 3
do. do. Income ...	Bonds	6	6	105	—	5 14 3
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	98⅜	—	5 1 10
do. Def.	„	1½	1½	24½	—	6 14 5
Automatic Telephone	1	10	12½	37/6	—	6 13 4
Cables & Wireless 5½ Pref.	Stock	—	—	97	+1	5 13 5
do. A 7½ Ord.	„	—	—	82	—2	... ...
do. B Ord.	„	—	—	50	—2½	... ...
Globe Tel. and T. Ord.	10	10	10	23½	—¼	*4 6 1
do. do. Pref.	10	6	6	10⅝	—	5 9 1
Great Northern Tel.	10	20	17½	29½	—½	5 18 9
Indo-European	25	10	10	47½	—	*5 5 8
Marconi-Marine	1	12½	15	2⅛	—¼	... ...
Oriental Telephone Ord	1	12	12	21/32	—	... ...
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref. ...	5	5½	5½	8 1/16	—	8 19 6
do. do. 2nd Pref. ...	5	6	6	8 1/16	—	9 16 0
do. do. 5% Deb. ...	Stock	5	5	75	—	6 13 4
British Electric Traction Def. Ord.	„	5	5	1600	—	... ...
do. do. Pref. Ord.	„	8	8	124½	—	6 8 6
Brazil Traction	100	7	8	53	—14	3 15 6
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	86½	—	5 15 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	9/6	—1/-	... ...
London United Tram Deb. ...	Stock	4	4	51½	—	7 15 4
Mexico Trams. 5% Bonds	—	5	5	72½	—	6 18 0
Mexican Light Common	100	Nil	Nil	85	—9	... ...
do. 7% Pref.	100	7	7	77½	—3	9 0 8
do. 1st Bonds	—	5	5	77½	—½	6 9 0
Yorkshire (West Riding)		Nil	Nil	5/-	—	... ...
Manufacturing Companies.						
Assoc. Elec. Ord.	1	6	—	31/3	+1/16	3 15 10
Babcock & Wilcox	1	13	15	60/6	—2/-	*4 19 0
British Aluminium Ord.	1	10	10	47/6	—	*4 4 5
British Elec. Transformer Pref. ...	1	7	7	18/-	—	... ...
British Insulated Ord.	1	15	15	4	—⅛	3 15 0
Brush Ord.	Stock	10	10	130	—	7 13 10
Callenders	1	15	15	3¾	—¼	4 0 0
do. 6½% Pref.	1	6½	6½	1¼	—	5 4 0
Crompton Parkinson Ord.	5/-	—	30	21/3	—	7 1 6
do. 8% Pref.	1	8	8	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	7 1 2
do. 5% Deb.	Stock	5	5	84½	—	5 18 4
Electric Construction	1	7½	5½	15/-	—	7 6 8
Enfield Cable Ord.	1	20	20	4 5/16	—1/16	4 1 0
English Electric	1	Nil	Nil	7/6	—	... ...
do. do. Pref.	1	8	Nil	8/9	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
do. Ord.	1	10	10	2 5/16	+1/16	4 0 0
Henley	1	25	30	6⅝	—1/16	4 14 1
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	Nil	Nil	11/3	—	... ...
Johnson & Phillips	1	10	—	2	—	5 0 0
Siemens Ord.	1	7½	7½	27/6	—	5 9 1
Telegraph Construction	12	10	10	23	—	5 4 2

* Dividends paid free of Income Tax.

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Industrial Electric Furnaces.

Illustrations of and Notes on Selected Items from Manufacturers' Products.

(*Concluded from page* 676.)

Messrs. Birmingham Aluminium Casting (1903) Co., Ltd., have installed a box-type furnace having a hearth 7 ft. long by 2 ft. 3 in. high by 2 ft. 6 in. wide, and a maximum rating of 70 kW at 440 volts, 3-phase. This is employed for the heat treatment of special aluminium-alloy castings used primarily in motor-car construction. By this heat treatment, carried out under the direct control of the metallurgist, certain alloys can be appreciably hardened. A Brinell hardness as high as 154 has been obtained, the average figure being between 130 and 150. The amount of hardening is dependent upon the temperature from which the metal is quenched, and it is therefore necessary, in order to obtain the best results that, not only should the temperature be controlled very exactly, but that all parts of the furnace should be of even temperature. In this furnace careful tests were made, and it was found that the temperature did not vary in any part by more than 3 deg. C. In order that the furnace can be used to advantage for small parts, large angle-iron racks have been constructed which run on rails into the furnace and also into a cage over the quenching tank which can be steam heated. This furnace was supplied by Messrs. Birmingham Electric Furnaces, Ltd.

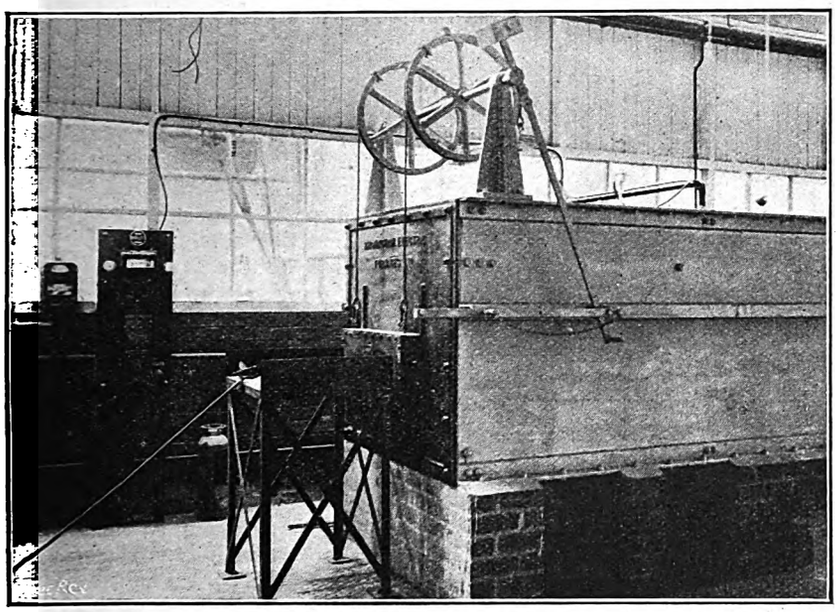

Fig. 5.—"Birlec" Pusher-type Furnace.

Another interesting "Birlec" furnace is that in the "Lightning Fastener" works of Messrs. Kynoch, Ltd. This pusher-type electric furnace, fig. 5, the exit end of which is water-sealed, is used for the semi-bright annealing of nickel-silver wire and strip. The oxide formed during annealing is extremely thin, and a few minutes in a weak sulphuric-acid pickle is all that is necessary, whereas with the old method of annealing a heavy scale was formed and a much longer period in a strong acid was required. The loss of metal is, therefore, reduced, and a saving effected in acid and labour costs of pickling. The approximate output of the furnace is 3 cwt. per hour, and the consumption is 150 kWh per ton. The method of operation is to pull out

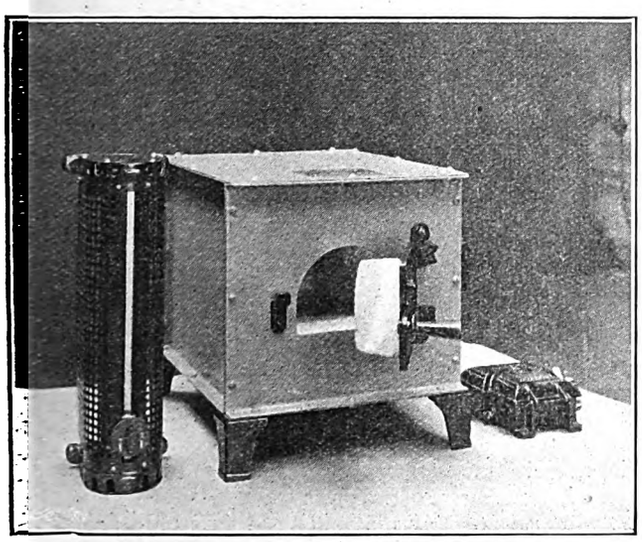

Fig. 6.—"Lecfur" Type B.E.S.3 Furnace.

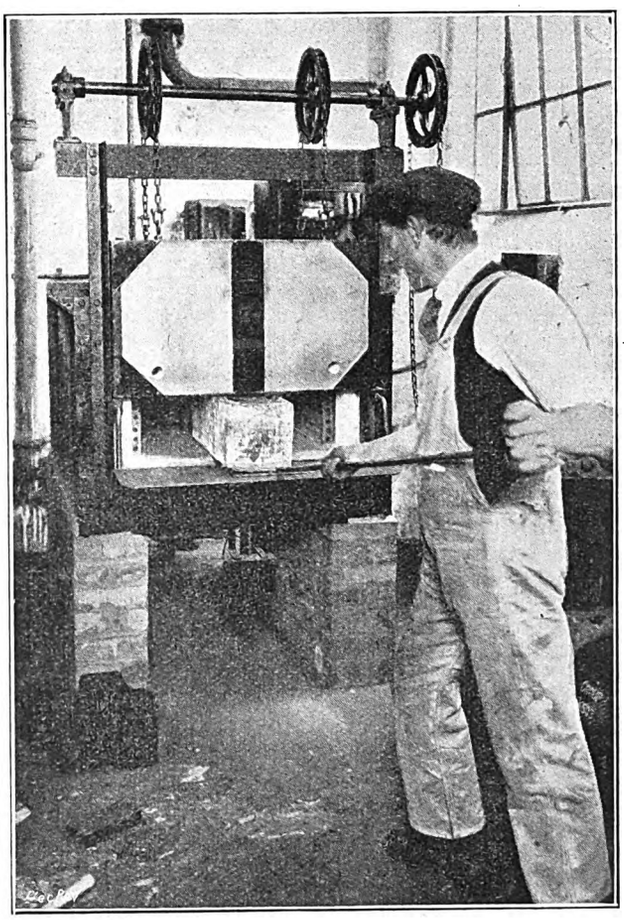

Fig. 7.—"Wild-Barfield" Carburising Furnace.

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the horizontal discharge door which forms part of the hearth and on which a coil rests. This allows the coil to slide down a nickel-chromium sheet into a tank. The discharge door is then replaced, the charging door opened, and another coil pushed into the furnace, thus moving the entire charge along the hearth. The "Lecfur" electric furnace, type C.C.8, fig. 9, is suitable for operation at temperatures up to 1,350 deg. C., and with a loading of 8 kW will reach 1,300 deg. C. in 3¼ hours. The size of the heated chamber is 8 in. wide by 9 in. high by 12 in. deep. It will be seen that the height is greater than the width, the object being to accommodate pieces of Ceramic ware smaller at the base than they are high. The same design of furnace can also, of course, be used for other industrial electrical heating operations, and in these cases where it is desired to bring the furnace up to its temperature more rapidly than is the case with Ceramic work, this can be done by arranging the furnace for a heavier electrical load. A feature of the furnace is the comparatively cool working conditions whilst operating at a high temperature.

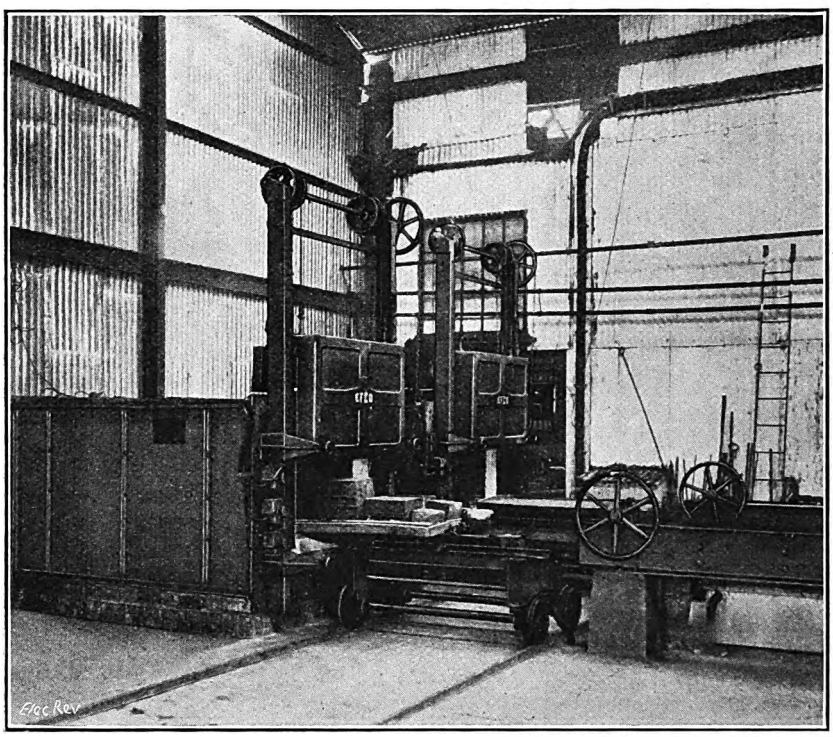

Fig. 8.—"E.F.C." High-efficiency Resistance Furnaces.

The "Lecfur" electric furnace, type B.E.S.3, fig. 6, with a heating chamber 5½ in. wide by 4½ in. high by 8 in. front to back, is used for annealing small parts, for the hardening and tempering of carbon-steel tools, for vitreous enamelling small parts, testing colours, glazes, &c., and a variety of other purposes. It is capable of operating at temperatures up to 1,050 deg. C. The electrical loading is 1⅜ kW, and it is capable of heating steel with this load at the rate of 20 lb. per hour to a temperature of 800 deg. C.

An Electric Furnace Co. installation is shown in fig. 8. It is a pair of high-efficiency resistance furnaces used for carburising. The operating temperature for each furnace is 950 deg. C. The loading in each case is 35 kW. The chamber dimensions are 5 ft. 9 in. by 3 ft. by 1 ft. 10 in. high

The following brief particulars concern three representative furnace installations for which Messrs. Wild-Barfield Electric Furnaces, Ltd., are responsible. Fig. 7 shows a box-type carburising furnace installed at the Erith works of Vickers, Ltd. The heating chamber measures 40 in. by 24 in. by 12 in.; the loading is 23 kVA. The furnace operates from a supply at 3,000 V, a.c., 50 periods, 3-phase, transformed to 88 V. The chamber is fitted with automatic temperature control. The installation is to replace gas furnaces used for the carburising of masticators for coal- and coke-pulverising plant. A box-type furnace for the heat treatment of elliptic and helical tramway springs has a chamber which measures 64 by 24 by 12 in., and the operating temperatures are 900 deg. C. and 350 deg. C. The furnace works on a 220-volt, 3-phase, 50-cycle supply, transformed to 129 volts. The maximum loading is 33 kVA. Automatic temperature control is provided at both temperatures. The above W.B. furnaces are fitted with the makers' patent double-pole door switch, which automatically deadens the heating chamber when the door is opened for charging and discharging, and also embody the Wild-Barfield patent thermal fuse which automatically cuts off the power should a temperature dangerous to the resistances be accidentally obtained.

Dealing with the subject of the speeding-up of engineering production at the Birmingham Metallurgical Society last year, Mr. A. R. Page pointed out that the heat-treatment of high-speed steels was a very important operation. The high temperatures necessary for correct hardening were difficult to control and, even if attained satisfactorily, they were not easy to measure accurately. The advent of electricity had placed in the hands of the engineer two further methods of hardening—the salt bath method and the dry electric furnace. For furnaces of moderate size electric heating afforded many advantages in operation and improvement in the quality of the product, and was actually cheaper. That statement was based on the industrial price of gas and electric power in Birmingham.

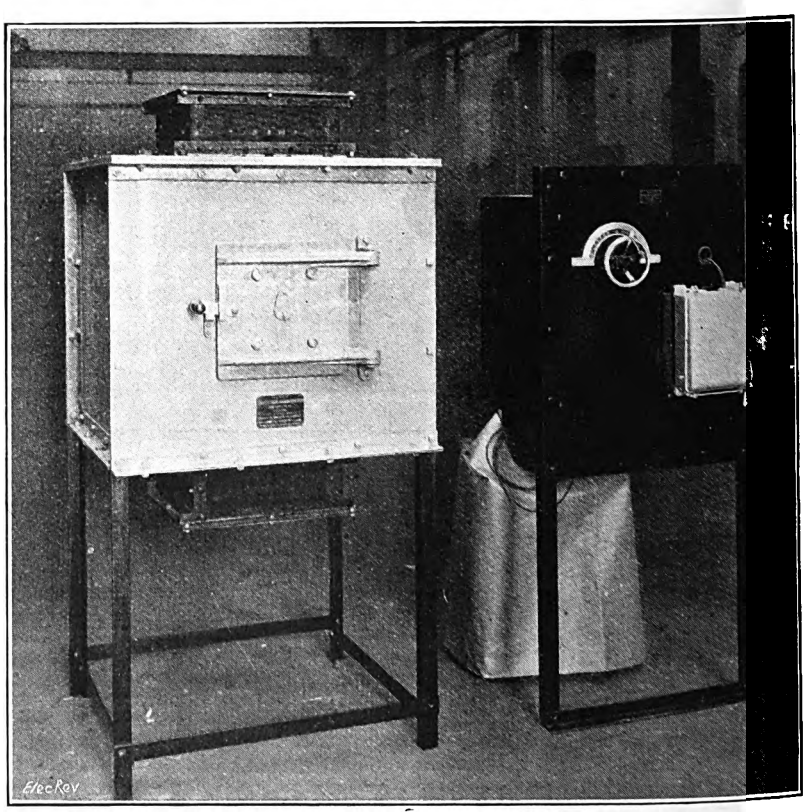

Fig. 9.—"Lecfur" Type C.C.8 Furnace.

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Rationalisation and Labour.

The author discusses the problem of employes displaced under reorganisation schemes and the future status of trade unions.

By H. C. PARSONS, F.I.S.A.

THOUGH rationalisation is slowly but surely spreading to many industries hitherto not regarded as susceptible to the treatment, there is still some uncertainty amongst the business men as to its benefits, whilst amongst the rank and file of labour and members of trade unions, there is a more pronounced expression of opinion on the probable consequences of future employment and the standard of living. Trade union leaders realise that whatever opinions exist with regard to rationalisation, its progress is inevitable and cannot be resisted, and that they must direct their efforts towards endeavouring to see that the tendency is beneficial to the workers at large.

Rationalisation means the application of science and scientific administration to industry in machinery and production. Research is being more and more applied to the improvement of working conditions, and the whole future of industry depends on its continued applications. There can be no halt with regard to efficiency in industry, and labour thus has a new point of view, with new responsibilities and difficulties. As rationalisation progresses, so must the co-operation of labour increase with it; to make it a real success, the brains that direct and the skill that operates industry, must work in very close relationship and harmony. Labour collectively, through its unions and associations, must not only prepare for the inevitable, but should be ready to influence and help direct it into the most beneficial channels.

The anxiety of the workpeople regarding rationalisation is found to vary to a considerable extent, according to the form which the particular scheme of reorganisation takes. One can easily imagine the worry it must cause to the most steady workers, when a rationalisation scheme involves the closing down of the factory in which they are employed, after, perhaps, a lifetime of work in the one place. Redundant though the works may be under a reorganisation, and though it may ultimately mean more work with the gradual absorption of the displaced workers, the intervening time may be one of hardship for many. It is perhaps easy for an outsider to extol the benefits of unification and efficiency, but it is another matter to persuade any human being, that depriving him of his work will be to the general good.

There is of course the other equally serious aspect, as to whether unemployment would not be much more serious if rationalisation was impeded and the old order of things allowed to continue. Intensified competition, particularly from the foreigner, with his better equipped business, is making it increasingly difficult for small concerns to carry on; they have not the capital to work out their own salvation, and unless they are "helped" by a larger concern, their ultimate end is to close down. This further depletes our chance of increasing our share of the world's trade. Whilst not forgetting for one moment the hardships caused to the displaced workers, it cannot be ignored that more suffering would accrue if the factory was not reorganised but entirely closed down, and it certainly would be short-sighted to subordinate the benefit of the community in general for the dubious advantage to a few.

There is also the very vital question of a probable decrease in skilled craftsmen with a larger increase in semi-skilled workers. Many of the modern labour-saving machines do not need a skilled operator's attention, and enable semi-skilled, and oft-times totally unskilled, labour to be utilised. No doubt it further reduces the cost, but has the ultimate result received the consideration it should, namely, the inevitable shortage of skilled craftsmen? This is perhaps the most serious disadvantage of rationalisation; it does not tend to encourage the rank and file to spend years of apprenticeship at small wages to learn a trade that in future years will be worth very little. There are shops to-day where with "labour-saving machinery" skilled and unskilled workers work side by side at the same rates of pay. There should, however, not be unnecessary alarm at this state of affairs. One has to go back over the past century or so to realise that rationalisation is but another step in the evolution of industry. Skilled craftsmen have undoubtedly dwindled in importance and have lost a considerable portion of their bargaining powers, thus considerably weakening the fighting strength of their unions.

It has been said that the present standard of living of labour has not been won by trade unions, but by other contributing factors, implying that the unions have flourished on labour prosperity, and not *vice versâ*. This can hardly be accepted as correct. Before labour combined and was able to bargain collectively, the working classes had no means of raising their standard of living, and the skilled man was undoubtedly inadequately remunerated.

It does not necessarily follow that labour prosperity will be adversely affected by the decrease in skilled workmen through modern efficiency methods, because it does not follow that labour prosperity is greatest where the unions are strongest, or least where they are weakest. Economic conditions of a particular trade or industry, may demand a strong union, but other contributing factors may react against the equivalent measure of prosperity. Rationalisation undoubtedly will react adversely upon trade unions for a time, until they have been rebuilt, perhaps after a serious struggle, on new foundations. That the unions have their place in the new order of things cannot be denied, but their fighting strength will be more political than industrial, and it is hoped that they will be the negotiating machinery between employers and employed in the new era of industry.

The Melchett-Turner discussions will, it is hoped, mark the commencement of a more peaceful period in industry, enabling the workers to have a say in the broader issues of industry than the mere question of wages, and it is hoped that the unions will be ready and eager to guide things along the right road. With the narrowing of the difference between the "skilled" and "unskilled" ranks, the worker will rely less on his trade union membership and will probably think along political lines. With the continued combinations and financial grouping that are going on to-day, organised labour will be likely to have a much more difficult time in the industrial field, but its political rise of the last few years, and its present political position, will do much to mitigate this.

Labour leaders realise that rationalisation has come to stay, and, undoubtedly, they will do their best to see that it takes the channels that will give the maximum benefit to the rank and file. That it will cause temporary hardship in some instances cannot be gainsaid, but it is also equally certain that unless industry is reorganised on the most efficient lines, we shall never recapture our position in the world's trade, competing as we do against the highly efficient industries of America and Germany, with the many trusts and combines tending to the exclusion of foreign imports.

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British Railway Electrification.

Brief observations on the Southern Railway Co.'s decision to convert its London-Brighton main line from steam to electric traction.

By A. T. DOVER, M.I.E.E.

THE recent announcement by the directors of the Southern Railway Co. of their intention to electrify the main line between London and Brighton forms an epoch in electric traction in Great Britain. The electrification of that railway was under consideration over 20 years ago, when the suburban lines of the old London, Brighton and South Coast Railway Co. were being converted to electric traction, and it was one of the reasons for the choice of the single-phase a.c. system for the South London and Crystal Palace lines. The war, however, caused the shelving of the scheme.

The present decision of the company to complete the scheme has been made possible by the Budget of 1929, in which the Government duty on passenger fares, hitherto imposed upon railway companies, was remitted on the condition that the money was expended on improving and modernising the railway systems. Thus one of the principal obstacles in the electrification of our steam railways (*viz.*, the heavy cost of the conversion) has been removed, and it is now possible for the railway companies seriously to consider schemes of electrification with a view to improving the passenger services. That such improvements are necessary is conveyed in a recent statement by Sir Josiah Stamp, president of the London, Midland and Scottish Railway Co., to the effect that if the big railway groups are to produce a profit they will have to carry a still larger number of passengers. Electrification should provide a solution to this problem.

The main line between London and Brighton possesses features which may be considered as ideal for conversion to electric traction. Thus the distance (51 miles) is relatively short, the route is fairly level, the passenger traffic is exceptionally heavy (about 1¾ millions of passengers are now conveyed annually between London and Brighton and, in addition, approximately 2,700 season ticket holders travel daily between the places), traffic congestion occurs over about 15 miles of route from the London termini, owing to the main-line tracks having to be used for certain suburban and local services.

The ordinary daily passenger traffic between London and Brighton (including the Hove and Worthing direct trains, which branch off the Brighton line at Preston Park, 1¼ miles from Brighton) is about 40 trains, of which about 30 may be classed as expresses. The Brighton main line as far as Wivelsfield (40 miles from London), however, is used by Eastbourne and Continental boat trains, so that the ordinary daily passenger traffic over the major portion of this line is about 70 trains.

In addition to the ordinary daily passenger main-line traffic, there is a number of mid-week and special (seasonal) excursion trains. Moreover, during the summer and at Christmas and Easter the normal train service has to be considerably augmented.

The fastest trains (*viz.*, the non-stop "limiteds") require 1 hour for the journey of 51 miles, and the ordinary expresses (which stop at one, two, and in some cases three or four intermediate stations) require between 1¼ and 1½ hours.

The trains are made up principally of compartment-type non-corridor stock, with the addition to certain trains of one or more Pullman cars, but the "limited" trains consist of Pullman cars, with the addition of corridor coaches in some cases. The train weights (trailing loads) vary between 200 and 350 tons.

Quadruple tracks are provided over practically the whole of the distance between London and Brighton, and, except near the London termini, the track is practically level and straight. The first 15 miles from the London termini, however, involve numerous junctions, curves and some adverse gradients, there being a gradient of 1 in 64 on leaving the Victoria terminus, which after about 1 mile of level track is followed by a steady climb of about 3 miles up gradients averaging 1 in 166, with short stretches of 1 in 80. This portion of the route, therefore, severely handicaps the present steam traffic, and the resulting average speed over the congested tracks is in consequence rather low. Moreover, as the congested portion of the route is nearly one-third of the whole distance from London to Brighton, the present timing of the fastest trains represents the limit for steam traction.

With electric traction a saving of at least 5 minutes should be possible for the non-stop trains over the congested portion of the route, and further savings of time should be possible for the ordinary expresses, compared with the present trains. Thus the "limited" trains should be able to cover the distance of 51 miles in between 45 and 50 minutes, and it should be quite practicable for ordinary expresses to do the journey in about 60 to 70 minutes.

Such an improved service with frequent trains will attract the additional traffic which the railways need. But the advantages which will accrue as a result of electrification must not be sacrificed by neglecting the signalling system, which must be augmented and increased in efficiency to cope with the larger number of trains and the higher schedule speed under electric traction.

Technical details of the electric services are not at present available. The direct-current system will be employed, and it is possible that the existing 650-volt conductor-rail system (as is installed on 250 route miles of the Southern Railway's suburban system) may be adopted, in view of the proposed extension of the present suburban electrification to Redhill (which is only 30 miles from Brighton) and the local traffic between Brighton and Worthing.

The main-line trains will naturally be hauled by electric locomotives, which for such service will have individual axle drives and geared frame-mounted motors, the power being transmitted from the motors to the driving axles through universal couplings or linkwork. Outputs up to 1,000 h.p. per axle are practicable. Such locomotives are now in service for express passenger traffic in Switzerland, France, Germany, and other countries, and a number of locomotives is being built in this country for the Great Indian Peninsula Railway. The performance of these locomotives is extremely satisfactory, the smooth running at high speeds being comparable with that obtained with the best bogie coaches.

Speed control with direct-current equipment is now much more flexible than in the early days of electric traction, owing to recent developments in the application of field control. For example, with a locomotive having three or four individually driven axles a total of from 13 to 15 economical running speeds is possible by the combination of double series-parallel control and field control; the motors are grouped in three combinations (*i.e.*, all series, series-parallel, all parallel), and four or five field strengths are employed with each combination.

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The Egyptian Electrical Market.

Schemes in Progress and in Prospect.

IT is clear from a recently-published D.O.T. report by Mr. R. M. Turner, O.B.E., Commercial Secretary at Cairo (Stationery Office, 2s. 6d. net) that the Egyptian Government has in hand and in mind many schemes for the benefit of the country. The only fear seems to be that it may proceed faster with its improvements than the economic development of Egypt warrants. As has been pointed out in previous reports, there is wealth in the country, but it is concentrated in very few hands. Nevertheless, under the auspices of the Government the general standard of life is being raised and in the towns there is general improvement and modernisation. The financial position of the country is sound; there is a favourable trade balance (which increased during 1928); and on the whole, Mr. Turner says, the general situation is such as to warrant no small degree of optimism regarding Egypt's economic development.

Irrigation and Drainage Projects.

The 1929-30 budgets of several of the Egyptian ministries include items for the carrying out of electrical and allied schemes. The Ministry of Public Works is concerned with a number of schemes on the Nile, mainly for irrigation. Diesel pumping plant is employed at many points, but at Nag Hamadi it is proposed to erect water-turbine generating sets with a number of motor-driven pumping stations to the north and south. Ten of these stations will be required for Esna. The initial expenditure for the installation of two three-phase transmission lines for feeding 14 subsidiary pumping stations is included in the Ministry's budget estimates. It is calculated that the ultimate cost of these cables will be £E500,000, but expenditure always comes well within the estimates. It may be assumed that similar transmission equipment will later be required for the Upper Egypt projects, the power for which would be provided by the Seru station, but no provision has yet been made for these projects.

The ambitious programme of development in irrigation and drainage by means of a chain of up-to-date pumping and electric generating stations throughout the Delta, and of separate stations in Upper Egypt, which was planned some years ago, but was held up by the war and other circumstances, was seriously taken in hand some few years ago. During the past two years contracts for the erection of important stations at Mex, Abu el Menaga, Seru, Atf, Esna, and Belcas have been placed, representing a total expenditure of £E551,797. Of these orders only one was secured by a British firm, that for the supply and erection of a station with three turbo-alternator sets with a Diesel-electric auxiliary set. It is thought that the preference shown for Continental tenders may be due to the design of Diesel engine offered. The large pumping station at Amria, which was supplied with machinery by a British concern in 1926, was officially opened by the King of Egypt early this year.

Electrification Possibilities.

Mr. Turner says that Egypt has not remained oblivious to the great advances made of recent years in the use of electric power, and it seems not unlikely that in the near future various schemes for electrification, which are at present somewhat nebulous, may take more concrete form. During the early part of the current year tenders were invited for the electrification of the Helouan railway, but were eventually refused on the ground that it had been decided to postpone that undertaking in view of certain more comprehensive schemes that had been put forward in the meantime. Similarly the proposals of a Franco-Belgian company, which had been formed with the object of erecting a large power station at Shubra for the supply of power to various existing undertakings, were not accepted. Other and more ambitious schemes in which interest has been shown by various British and other groups envisage the more or less general electrification of the whole country, either with thermo-electric or hydro-electric stations or a combination of both. In connection with the suggestion that the required power should be generated hydraulically, it is of interest to note that in their report on the question of heightening the Aswan dam the international experts advised that the fabric of the dam should not be pierced for the purpose of harnessing the water. It is believed in some quarters, however, that the desired result could be obtained without piercing the dam, as it is also contended that the difficulties attendant on the transmission of power from such a far distant source to the centres of consumption could also be overcome. Another scheme, which, however, is considered by many to be uneconomic, if not impracticable, is connected with a proposal to conduct water from the Mediterranean and flood the desert area at Quattara, which lies several metres below sea level. This scheme would need extensive tunnelling operations, and although of manifest interest is unlikely to be undertaken at an early date. Surveys and borings are, however, being undertaken.

Apart from the employment of the power obtained from the contemplated stations for railway electrification, it is claimed that it could be advantageously used to drive the very large number of pumping stations, both great and small, on which Egyptian agriculture depends, and which, as the amount of water available increases with the completion of the raising of the Aswan dam and the erection of the dam at Gebel Aulia, must be augmented. Further, besides the existing flour mills whose consumption of power is considerable, the fact that power was available at practically all centres would materially facilitate the growth of the Egyptian industrial movement, through which it is hoped to solve the question of the employment of the rapidly growing surplus population. It may be added also that, in connection with the proposal to erect a power station in connection with the Aswan dam, the construction of a plant for the manufacture of artificial fertilisers has been mooted.

Expenditure upon Communication.

The allocation for 1929-30 to the Egyptian State Railways includes items of £E77,000 for the extension of the Gabbari power station and £E30,000 as the first contribution towards the £E190,000 which, it is estimated, will ultimately be spent on the electrification of the Matarieh railway line, if or when this project is put into execution.

The Telegraphs and Telephones Department receives a credit of £E1,335,085, of which £E616,500 is in respect of new works. The expenditure on works already commenced includes £E200,000 in respect of the underground telephone line between Cairo and Alexandria and £E90,100 for automatic exchanges. One of the most important projects is that for the proposed 15,000-line exchanges at Alexandria which will probably be later extended by a further 5,000 lines. Included in the current year's credits are the following items:—Four portable radio-telegraph installations for use in the desert (£E10,000); radio-telegraph stations in the oases (£E8,000); the laying of new underground telephone lines at Cairo (£E27,000), Alexandria (£E12,000) and Heliopolis (£E11,000); and the substitution of a cable for the overhead lines between Cairo and Helouan and Meadi (£E18,600).

Electrical Import Trade.

The exceptional advance in imports of British electrical machinery was unfortunately not maintained during 1928. The total imports of this class declined, but Great Britain's share fell disproportionately and France rose to first place. Italian competition, though of less importance, is increasing. Mr. Turner considers that the cause of this decline is apparently the fact that British prices are far in excess of Continental quotations as British firms do not manufacture the cheaper lines so popular in Egypt. British trade is made more difficult by the absence of electrical regulations. An appendix to the report puts the total value of electrical machinery imported in 1928 at £E152,389. Of this the United Kingdom was responsible for £E32,374 and France for £E43,089. The imports of electric batteries, accumulators and parts were valued at £E35,089 of which the United Kingdom accounted for £E14,819 and Germany for £E5,640. Imports of uninsulated electric copper wire were valued at £E23,309, of which France contributed more than half, while the modest share of the United Kingdom, though almost double that of 1927, was still only roughly one-quarter of the total import. On the other hand, British supplies of armoured electric wire and cable mostly to the order of the Egyptian Government reached a total of 2,110,717 kg. valued at £E102,863 in 1928 out of a total import of 3,076,212 kg. worth £E146,151, representing an increase in British trade of some £E79,132. French and German deliveries fell away very considerably. The total imports of insulated electric cables during 1928 amounted to 322,236 kg. valued at £E35,597, representing an increase of some £E3,000 compared with the previous year. Germany, France and Belgium in the order named remained the chief suppliers, but United Kingdom deliveries, though small, showed a decided increase. Telegraph and telephone apparatus imports declined considerably, but the majority of the few Government orders placed were secured by British firms. The total business was only worth £E27,395, as compared with £E70,193 in 1927.

Trading Conditions and Advice.

Keen foreign interest is shown in the Egyptian market. This year considerable attention was attracted by an exhibition of French industrial products organised by the Comité Français des Expositions and there is some talk of a German industrial exhibition in the near future. A permanent exhibition of Japanese products is maintained at Cairo. The British

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Chamber of Commerce in Egypt is consolidating its position as one of the leading business institutions in the country and has been of considerable benefit to the British trading community. The development of the Egyptian market during the past year has again demonstrated the need for a very careful selection of local representatives. The success of competitors must be ascribed in no small measure to the greater trouble which they take to investigate the market. The number of foreign business men who visit Egypt increases every year. These men study the market in conjunction with their local representatives and obtain a valuable first-hand knowledge of its requirements. Mr. Turner stresses the necessity for the home firm to give its representatives the fullest support and to understand the difficulties which they have to encounter. British-made goods stand high in Egyptian opinion, but they will not sell themselves.

Trade Possibilities in Russia.

The Report of the British Trade Delegation.

IT will be recalled that in March and April this year a very representative delegation from many branches of British industry paid a visit to Russia under the leadship of Sir Joseph W. Isherwood, Bt. The object of the visit was to improve business relationships between this country and Russia and to make a study of Russian conditions and prospects. It was appointed by the Anglo-Russian Committee, 4, Lloyd's Avenue, E.C.3, the formation of which was due to Mr. Ernest Remnant, and this Committee has now published the Delegation's report. (Price 2s. 6d.).

The Delegation was composed of 24 members representing over 1,500 British firms with capital resources exceeding £700,000,000. The engineering industries sent a strong contingent and several electrical concerns were represented. The party arrived at the Russian frontier on March 27th and were received by Mr. Rabinovitch, representing the All-Russian Western Chamber of Commerce, and they reached Moscow on the following day. At a reception arranged by the above-mentioned Chamber of Commerce the delegates were welcomed on behalf of the Soviet Government by Mr. Khinchuk. The latter said that his Government viewed with grave concern the diminution of trade between the two countries; that would not have occurred if Russia could have traded with Great Britain on the same terms as it traded with other countries. The wide and rapid industrialisation of Russia increased its needs for machinery and equipment and extended the possibilities of exporting raw materials and foodstuffs.

Following upon the suggestion of the Russian authorities the delegates were grouped according to their various interests preparatory to visiting works, laboratories and other organisations, each group being placed in charge of a Russian acquainted with the subject. An Economic Committee, comprising Sir Joseph Isherwood, Mr. E. Remnant, and Mr. Drummond-Wolfe, interviewed Mr. Litvinoff, the Acting Minister for Foreign Affairs, and discussed general relations between the two countries. It was considered that no insuperable difficulties existed in the way of a mutually satisfactory settlement of outstanding problems. Subsequently the Committee met Mr. Piatakov, Acting Chairman of the State Bank, and other officials. Mr. Piatakov welcomed the investigations of the delegation, and pointed to the falling-off in trade between Great Britain and Russia since 1925. Whereas in 1925-26 Great Britain's share of Russian import trade was 18.6 per cent., in 1927-28 it had fallen to 5.5 per cent. In the latter year the total value of machinery imports was 222 million roubles; Great Britain accounted for only 10 million roubles' worth. The State Planning Commission had drawn up a five-year development scheme which would be proceeded with in any event. If relations with England improved, however, the plan might be modified to England's benefit. It was intended to expend under the five-year plan a total of 54 billion roubles, of which 3.85 billions would be required for the electrification programme. If Anglo-Russian relations remained irregular only absolutely necessary orders would be placed in Great Britain, but if a satisfactory agreement could be reached, and a financial programme could be drawn up, it would be easy for Russia to place industrial orders amounting to £150,000,000. Should English capital be willing to take up concessions and investments the figure could be increased to £200,000,000 and more. That did not include staple commodities—such as cotton, wool, copper, rubber, &c.; such purchases could also be effected through the medium of the English market. It was essential, first, that diplomatic relations should be resumed.

The departmental discussions with the other groups were so well arranged that they were completed during the first week. On April 10th a meeting of the delegates passed a resolution, submitted by the Economic Committee, to the effect that no economic development between the two countries was possible without the resumption of normal diplomatic relations; and that the Russian Government required financial assistance, but this could only be afforded if the claims of British nationals were satisfied. The Economic Committee was instructed to approach the Soviet Government to obtain a definite assurance that it was willing to open negotiations upon this matter. It was agreed that an early meeting should be held in London to secure the realisation of the objects of the Delegation in visiting Russia. When the Committee placed the resolution before Mr. Piatakov he said that his Government could not carry on any further discussions of an economic nature with individuals other than those authorised by the British Government. He furnished to the Committee, in confidence, particulars of Russian requirements for the next five years which included boilers, turbines, dynamos, machine tools, and industrial machinery; cold storage plants; elevating machinery; conveyors and transporters for docks; the building of electric power stations (including stations in Moscow and at Svir); telegraph and telephone supplies, &c.

The delegates paid visits to a large number of establishments including the Leningrad Boiler Works, the Moscow and Leningrad Cable Factories, the Bogoredsk Electric Steel Works, the New Turbine Works, Leningrad, the "Nobel" Diesel Works, Leningrad, the Wire-Drawing Works, Moscow district, the Moges Power Station, Moscow, the New Post and Telegraph Offices, Moscow, the Ministries of Transport and Railways, Moscow, the Department of Ways and Communications, Moscow, and the Moscow Accumulator Trust. Some of these were the subject of comments by delegates. The "Nobel" Diesel Works was said to give the impression of considerable activity. The works was well equipped with machine plant generally, but production costs appeared to be high and output low. The capacity is 20,000 h.p. per annum and 1,300 workers are employed. Good impressions "so far as could be gathered" were obtained from the Bogoredsk Electric Steel Works. The Moscow district Wire-Drawing Works was said to be short of technical help, very well equipped, but lacking in skill. It was thought that the cable factories in Moscow and Leningrad compared favourably with any of the cable industries in this country; the latest type of machinery was employed. The Moges (Moscow) power station was erected before the war, but it is now being re-built with Babcock & Wilcox boilers and Metropolitan-Vickers and B. & W. turbines. It has a capacity of 80,000 kW, but is to be extended to 107,000 kW. The Southern Machinery Trust, Kharkoff, is housed in a magnificent new building. It controls 48 factories, including locomotive, Diesel engine and boiler works, &c.

Every department of the Government seemed to be working with enthusiasm to contribute its quota to the five-year development plan. The factories appeared to be well organised, but lack of trained technical staff and skilled labour combined with wasteful production methods to increase costs. Many of the plants visited were antiquated and their machinery required replacement, but some of the newer factories were most up-to-date. The directors, generally speaking, had a high standard of technical knowledge but lacked practical experience. The steps which were being taken to make good the deficiency of skilled labour included piecework remuneration, the working of two, or sometimes three, shifts, the institution of schemes of technical training, and the fostering of a competitive spirit among the workers.

The opinion was definitely formed that there will have to be a considerable speeding-up of the output before Russian factories can compete with those in other industrial countries. The trusts claim to make a profit, however, and state that the capital value of their organisations has greatly increased during the last three or four years.

After reviewing transport and communication conditions, the Committee deals with the resources of Russia which await development. For the exploitation of these resources the Soviet Government is seeking the co-operation of foreign capital, which is invited to participate by granting credit facilities over a sufficiently long period for the purchase of the necessary machinery, and by direct exploitation through the taking up of concessions for a term of years. During the next five years considerable efforts are to be made to increase the country's exportable surplus, especially that of the agricultural industry. The production of pig-iron and steel in 1927-28 was below the pre-war level, but steps are being taken to increase the output. The same may be said with regard to copper production. In this case the falling-off has been considerable—from 32,000 tons in 1912 to about 2,000 tons in 1921-22; by last year, however, the output had risen to 13,000 tons. Two new plants are under construction for the production of copper.

A chapter of the report outlines the general principles under

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which concessions are granted. The objects are two-fold: the attraction of new working capital, and the study of the methods employed by the concessionaires. The latter can import the necessary machinery free of import duty, but other taxes are levied upon the same basis as for the State factories. These taxes may be covered by the payment of a fixed proportion of the profits, if desired. The concession is for 50 years, during which period the capital is redeemed by a sinking fund and the amortisation of plant is effected. At the end of the term the undertaking passes to the Government. Profits can be exported, exchange at the full official rate being provided by the Government. Labour conditions are arranged by collective agreement with the trade unions. The average profit on the capital invested in 22 concession undertakings (including those working at a loss) rose from 27.1 per cent. in 1925-26 to 85.2 per cent. in 1927-28.

In its conclusions the Committee says that Russia is potentially a very rich country, and her industrial reorganisation is being carried out to the limits of her financial capacity. At present the necessary financial facilities are only obtainable on very uneconomic terms, and there is accordingly every inducement for Russia to enter into trading operations on a large scale with British firms. The delegates were afforded every facility for investigating and discussing with the heads of the various Government departments the matters of interest to them, and reliable general information was obtained as to the very large amount of business available for this country. The barrier is Russia's lack of credit and liquid financial resources, and the Government can only enter into obligations of an extensive character to meet the needs of the Russian people if long credit can be obtained on reasonable terms. For the proper development of her vast resources Russia requires capital to an extent that can apparently only be met by way of loans raised under equitable conditions, or alternatively, by granting concessions to foreigners with capital to undertake the work of development. The Soviet Government is, however, insistent upon the renewal of diplomatic relations with the British Government as precedent to a discussion on economic questions. It is stated that at no time did any representative of the Government question the justice of the demands of the Committee in the matter of the claims of British nationals. The Committee is of the opinion that the British Government could, and should, obtain assurances and/or guarantees from the Soviet Government, both with regard to the claims of British nationals prior to 1917 and to the cessation of hostile propaganda, such as would justify its resuming diplomatic relations, when the Soviet Government would be prepared to discuss in detail all questions of an economic character as well as other questions outstanding between the two countries. The Committee is satisfied that there is a great volume of business available for Great Britain, subject to diplomatic recognition being afforded, and if arrangements be made for the financing of the business on long-term credit or otherwise.

American Capital in German Industry.

A Press Battle Between the Siemens and A.E.G. Concerns on Foreign Control.

It will be remembered that last year certain large British manufacturing concerns found it desirable to introduce measures to prevent foreign holders of shares therein from exercising powers of control. Sir Hugo Hirst, Bart., representing the General Electric Co., Ltd., played a leading part in the movement and in the discussions and meetings that took place between interested parties.

As was mentioned briefly in our "Business Notices" last week, the subject has now become a very "live" one in Germany by reason of the increasing influence which American finance is coming to possess there over both productive and public utility concerns. The situation is particularly interesting because there has been a battle of argument between the heads of the Siemens concern and the Allgemeine Elektricitäts Gesellshaft, respectively, in the German newspapers. For the information which follows we have drawn upon the statements appearing in these newspapers, both the attack of C. F. von Siemens, and the reply by the A.E.G.

In the *Berliner Tageblatt* for October 13th, that paper in referring to the reported transaction by which the controlling interests of the Mix and Genest Co. and of the South German Telephone, Cable & Wire Co., with the F. Schuchardt Co., all belonging directly or indirectly to the A.E.G. concern, are to be combined in a holding company under the control of the International Telephone & Telegraph Co., of America, said that it had provoked the Siemens Co. to a quite unusual attack on German companies, as they evidently felt that this combination was directed against their interests. It was quite usual in German industry, said the *Tageblatt*, for adversaries of such standing to fight one another with tactical moves and intensive competitive measures, but attacks had seldom been made in the form of public speeches.

The Siemens Statement.

Dr. C. F. von Siemens, the chairman of the Siemens and Halske Co., on the occasion of an internal celebration of the Siemens groups of the 82nd anniversary of their foundation, delivered a speech which was openly directed against the capital policy of the A.E.G., the largest German competitor of the Siemens group. Herr von Siemens said that the difficult times through which they had passed and all the privations and dangers of the present time, had forced all those who stood at the head of affairs to act as the captain of a ship in a heavy sea. All measures had to be directed to the saving of crew and ship in the hour of danger, but the easiest course could not always be taken without allowing the ship to drift further and further away from the port of destination, and at the earliest possible moment a definite course must be taken. He said that it seemed to him that many leaders of the once proud electrical industry had too soon relinquished the wheel and called in the foreign pilot, because they did not think it possible to master the tempest by themselves. They did not make the work easier for those who hoped with their own strength and with their own crew to recover the proper course and to keep the German ship in the leading line in competition with foreign nations. The foreign pilot, even if he was only standing next to the German helmsman in a consulting capacity, would not and could not give his advice with the strong feeling of common interest between leaders and crew. How much less so if the pilot was in addition navigating ships of his own under the flag of his own country in competition with German enterprise. He would use his German captains as assistants for the will of foreign countries. What he considered undesirable or what was opposed to his orders or interfered with his plans, would be kept down with German support.

As the economical conditions in Germany had been developing, they were unfortunately no longer in a position to obtain the necessary means for the development of a growing industry from their own German sources. They must get the assistance of foreign gold created by German labour. They all knew that this foreign gold waited for the moment when it could get the supreme control of large enterprises which hitherto had given orders to Germany.

They must prepare for new fights. He was confident that they could successfully go along the old path of progress without jeopardising their German character if they had the intelligent support of all the authorities who had the duty and responsibility to maintain German industry.

These sentences, said the *Tageblatt*, the sting of which was only slightly concealed, followed logically a short but very dramatic scene created by Dr. Sempell, a member of the board of the United Steel Works, and as such also a member of the Siemens board, at the meeting of the Association of German Industry. He pointed out, without mentioning the names of the A.E.G. and Osram, that he considered a preponderating foreign influence damaging to German industry to be already existing if only a large minority of shares was placed in foreign hands and if the representation on the boards in such cases was not sufficiently balanced in favour of German capitalists. Mr. Bucher, of the A.E.G., made a very vehement reply to these remarks. He was much more pointed than Dr. Sempell at the time, but he did not specially refer to the electrical industry.

The *Berliner Tageblatt*, continued, remarking that nobody knew what the arrangements would be for the new holding company, particularly the International Telephone & Telegraph Co., which controlled the majority of that holding company, and what technical compensations it would offer to the new enterprise in addition to assisting it with capital. The writer could not imagine that only fear of competition intensified by technical and capital assistance had caused the unusual procedure at the Siemens works. Some national idealism might also be involved, perhaps also the disappointment that it had not been found possible to unite the two large German electrical concerns in some shape and strengthen their position in foreign countries. There were times when such ideas were actual, and when certain attempts were made to bring about such an arrangement. Was the A.E.G. to blame at the time that the negotiations failed, or was the Siemens concern responsible for the failure of such an arrangement many times expected and predicted by the Stock Exchange? The development had gone other ways, and the two electrical groups faced each other in a fighting attitude such as had never before been so clearly expressed. This position was not altered by the fact

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that in some enterprises both companies were co-operating, such as, for instance, in the Osram Co., in which apparently the Siemens group as a large shareholder had not objected to a participation of the American General Electric, although only to a small extent.

The *Tageblatt* concluded by saying that it would be interesting to see how the fight continued, and what its effect would be both upon the electrical industry and in the economic field generally.

The A.E.G. Reply.

In the *Berliner Börsen Zeitung* of October 16th, the reply of the A.E.G. was published. The company first expressed the view that as the Siemens statement had been issued to the Press, and the leaders and the business measures of the A.E.G. had been criticised therein, they were forced to comment upon it. They regretted this because they did not approve of this kind of business propaganda and argument for big firms of standing. It was open to discussion in what way foreign capital should participate in German industrial undertakings. Siemens agreed that such participation was necessary; opinions only differed with regard to the form it should take. It was being discussed whether bonds were less dangerous than participations in share capital. Future experience would decide who was right. They (the A.E.G.) were of opinion that no general rules could be set up for all such cases. Each separate case would have to be carefully studied in order that an opinion might be formed.

In the case of the Osram Co., in which the two firms participated equally, *viz.*, A.E.G. and Siemens, they had mutually decided to grant the General Electric Co. (U.S.) a participation of 16⅔ per cent. in this company, despite the fact that in this case the co-operation of foreign capital was not necessitated by lack of funds. This decision was arrived at mainly by purely commercial considerations regarding the international situation of this enterprise which all parties concerned considered to be economically correct, well in keeping with national dignity and advantageous for private industry.

Similar reasons caused the A.E.G. to enter into commercial agreements with the International General Electric Co. with which the firm had been on friendly terms for 25 years. The aim of these agreements was chiefly to increase sales in the international markets; they were welcomed and considered advantageous by the management, the board of directors and the general stockholders' meeting of the A.E.G. In exchange for the advantages offered, which they hoped would not only be enjoyed by their firm, but by their entire staff of workers and employés, and thus by the whole German industry, the A.E.G. had handed to the International General Electric Co. a block of shares amounting to 15 per cent. of the share capital which had been increased to the amount of Rm. 200,000,000.

Why, asked the A.E.G., should that be wrong and a danger to German economy, what in another case was considered right and correct from a national point of view? It could only be a question of the extent of foreign participations. The A.E.G. had never tried to conceal that it knew that the International General Electric Co. had bought up shares of the firm in the open market. It knew exactly the amount of the shares bought and did not consider the amount together with the above mentioned shares to be any danger to its independence and safety as an independent German enterprise. As was pointed out at the last A.E.G. general stockholders' meeting without meeting with any public opposition, the purchase of shares of German enterprises on the part of foreigners could only be avoided if a sufficiently large amount of capital available for investments existed in Germany. In the near future it would become more and more evident that the necessary capital could not be procured. They also hoped that the financial leaders of Germany would realise in time the great danger in which German finances were being placed on account of lack of capital.

Under these circumstances, the A.E.G. saw no other remedy than to try to regulate the holding of shares by foreigners. They had succeeded insofar as the A.E.G. was concerned. Did the Siemens firm know exactly how many of its shares available in the open market were in foreign hands? Probably it was not a small percentage. All other conclusions drawn from this situation by Mr. von Siemens were vague suppositions.

What right had he to call them an instrument of foreign interests? Patriotism and interest in national matters were not handed down as an inheritance. They also claimed to be in possession of these qualities. No reason or right to make this criticism existed and they denied it. Where there was no reason there must be a purpose. Perhaps the underlying purpose of these statements was to influence the public against concerns having "excess foreign participations." There was no excess foreign participation in the A.E.G.; it was a German enterprise.

Most of their shares were in the hands of thousands of German citizens. They had reason to believe that with regard to their number as well as the amount of nominal capital invested, they exceeded those of the Siemens concern of which, as was generally known, the principal share-holding was in the hands of a smaller group. Not the management of the A.E.G., but the German shareholders and thousands of working people would be the sufferers if such propaganda were successful. They presumed that this strange attitude of the responsible leader of a leading concern against the business policy of another concern must have other motives. A further decisive motive for the attitude of Mr. von Siemens was found in the proceedings which had been going on in the telephone industry. The difficult position of the smaller firms in the telephone industry was sufficiently known to the public. The A.E.G. participated to an important extent in the firm of Mix and Genest. The A.E.G. had been engaged in long drawn out negotiations with the firm of Siemens & Halske with regard to the pressing need for a consolidation in this industry. The necessity of consolidation had been recognised for it formed the basis of these negotiations. Their conversations failed because, on the one hand, the firm of Siemens & Halske demanded the right to exercise a strong influence in the creation of a second telephone organisation and the A.E.G., on the other hand, did not want to be accomplices in a monopoly.

In the meantime foreign capital made use of the opportunity to obtain an influence over the smaller German telephone enterprises as they feared that the struggle against the various interests in this branch would become more acute and the confusion would be greater. They felt that it was advisable to bring their interests in the telephone industry together with those of Felten & Guilleaume into a new company founded in co-operation with the International Company. This company had as its purpose a consolidation of the German telephone industry and the possibility of sustaining itself to the greatest extent with the help of foreign technical invention and discoveries, *i.e.*, with the co-operation of the most important telephone company of the world and of utilising progress made in this branch of activity for the benefit of German economy. Here also the A.E.G. left judgment of the justification of these measures to future developments.

Progress in Illumination.

Extracts from a report issued by the Papers Committee of the Illuminating Engineering Society.

THE opening meeting of the session of the Illuminating Engineering Society is customarily devoted to reports on progress and exhibits of lighting novelties. Hitherto it has been usual for the honorary secretary to review progress during the vacation, and for developments in gas and electric lighting to be dealt with by separate committees. It was felt by the Council, however, that a single report surveying progress in all directions would be preferable, and thus the present report has been compiled by the Papers Committee. The report of the Council was presented at the annual meeting in June.

Of conferences held, several not specifically devoted to illumination have been marked by references to, or demonstrations of, lighting effects and the organisation of exhibits illustrating progress in lighting. Such congresses afford excellent opportunities of showing what can be done and arousing sympathetic interest in better lighting.

Specifications and Reports.—Several important specifications have been added to the list of publications of the British Engineering Standards Association. Amongst them may be mentioned Translucent Glassware (No. 324), Tungsten-Filament Lamps (No. 161), Neck and Flange Dimensions for Illumination Glassware (No. 364), and Photometric Integrators (No. 354). It will be recalled that the last specification for electric lamps, published in 1928, revealed a material improvement in efficiency and in the degree of accuracy in the adherence to light-centre lengths. An addendum slip, substituting 15- and 25-watt internally-frosted lamps for the 10-, 20- and 30-watt lamps and standardising 40-, 60-, 75-, and 100-watts of the internally-frosted type (the light output, efficiency, and life being identical with those for clear lamps) has been added. It is understood that a further general revision of the specification will be issued. Experience of the application of the principles of the British Standard Specification for Street Lighting has been acquired; a few respects in which modification may be necessary are now being considered. Useful work continues to be done by the committees working under the National Illumination Committee, and the investigations of the Illumination Research Committee are being continually extended. The ninth annual report of the Industrial Health Research Board summarises investigations conducted on the relief of eyestrain, showing the value of specially constructed spectacles and illustrating the close connection between lighting requirements and visual effort. H.M. Chief Inspector of Factories states that records of factory lighting are still being compiled. Attention is drawn to the unsatisfactory lighting conditions still existing in certain industries. Notwithstanding bad examples, there are indications of steady improvement and many of the newer factories are now equipped with excellent systems of lighting. Further evidence of improvement is afforded by the results of the Factory and Workshop Lighting Campaign of 1928, which are summarised in a report issued by the British Electrical Development Association.

"*Festivals of Light.*"—An important development on the Continent has been the series of "Festivals of Light," during which special efforts were made to bring the possibilities of lighting before the public by displays of shop-window lighting, luminous signs, floodlighting, &c., which have led to a permanent improvement in general lighting, and proved

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profitable from the business standpoint. It is hoped that this precedent will be followed in this country. The taxes levied on lamps and on electricity used for lighting in Italy render development work there difficult.

Lighting Education.—Education in illuminating engineering continues to excite comment. There is a general feeling that more should be done to bring the importance of good lighting prominently before the notice of students taking courses in architecture and engineering, and that popular lectures and addresses, both to adults and to children in schools, should be more frequently organised. The subject is receiving attention from a committee working under the National Illumination Committee of Great Britain. An event of considerable interest was the opening of the new Lighting Institute in New York, which occupies a complete city block and enables demonstrations to be staged on an unprecedented scale.

Photometry.—There are no very notable advances in photometric instruments and processes to record. Perhaps the most interesting development has been the increasing use of photo-electric cells for photometric measurement and for obtaining records of a variable illumination, such as that furnished by natural daylight. A new type of cell, which is sensitive to infra-red radiation, has recently been developed and may have useful applications in connection with the study of radiation.

Lamps and Fittings.—Frequent reference has been made to the need for standardisation, and some progress towards simplification has already been made; it is hoped that this will continue, with benefit both to the quality and to the cost of the lamps. It has been computed that by concentrating on internally-frosted and "opal" lamps it would be possible to diminish some 60 or 70 existing types to less than one dozen. The comparative effect of lamps with clear and internally-frosted bulbs on the light distribution and appearance of fittings has, however, been the subject of some discussion.

A feature during the past year has been the progress made in the manufacture of lamps of very high capacity. Incandescent electric lamps consuming 3 to 4 kW are now widely used for lighthouse work, and some of 10 kW (and even higher capacity) have been developed for the lighting of aerodromes. A new field for the use of such lamps is presented by the film-making industry, and for making "talkie" films incandescent lamps have recently been in great demand; this tendency has also been aided by the introduction of the panchromatic film. The use of high-candle-power incandescent lamps in studios presents numerous interesting problems, which it is hoped will form the subject of a paper before the Society in the course of the present session. In some Continental cities there are instances of single lamps of exceptionally high candle-power being applied to public lighting, *e.g.*, on posts 60 ft. high or more in large public squares.

A feature in the design of lighting fittings has been the continued popularity of totally enclosed diffusing glassware. There has been a distinct improvement in the qualities of diffusing opalescent glass, and new types of prismatic glass units have been developed. However, owing to this variety of types existing, and the variations experienced even in one and the same type of glassware, some simple method of defining diffusing properties is needed. The subject is now receiving attention from a sub-committee of the N.I.C.

Another feature has been the extending use of luminous panels recessed in the walls and ceilings of rooms, for shop lighting, and "artificial skylights" equipped with "daylight" glass in some cases where correct appearance of colour is desirable. Panels of prismatic glassware have also been developed, and will prove useful for special types of work, such as the lighting of operating theatres in hospitals, where an extensive luminous source, coupled with concentrating effect, is desirable.

Architectural Lighting.—Whilst one of the main tendencies of recent years has been the freer use of higher intensities of illumination, an equally significant development has been the more general adoption of lighting for other than purely ultilitarian purposes. Fittings developed during the past year have been noteworthy for the departure from existing traditions and for the increased attention paid to decorative effect. Lighting fittings of the future will doubtless be influenced materially by this movement towards "architectural lighting," a feature of which is that the lighting units become an integral part of the architectural scheme.

Floodlighting.—Apart from the growing practice of floodlighting public buildings, there have also been instances of the applications of such methods for utilitarian purposes, notably for the lighting of railway goods yards, and a type of directive projector has been found very successful in dealing with long parallel sidings.

Street Lighting.—Reports issued by public lighting engineers reveal steady progress. An outstanding feature of the use of artificial light on roads has been the many experiments with luminous traffic-control signals. Systems have been installed in more than 40 cities, and the issue of the recent memorandum on this subject by the Ministry of Transport is an illustration of the importance attached to this new branch of illuminating engineering.

Electrical Communication Engineering.

Some aspects and activities that have contributed to the wonderful expansion of the range of telephony in recent years.

By COLONEL SIR THOMAS F. PURVES, O.B.E., M.I.E.E.

(*Extracts from the presidential address before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

WHILST the dissemination of power, light, and heat by electrical means is an achievement in the service of humanity, the communication engineer is inspired by the reflection that his *métier*, the transmission of thought, intelligence, and information, is a no less worthy contribution to the status and to the legitimate pride of the electrical engineer.

To-day one can speak from any telephone in this country to nearly 90 per cent. of the telephone stations of the world.

The Automatic System.—The installation of full automatic systems, in which even the selection and interconnection of the lines is performed by electromagnetic machines, is being pushed forward with increasing momentum all over the world, and the system specially evolved for the service of London is realising in practice the hopes that had been founded upon it. Twenty-one large exchanges with an aggregate capacity of about 132,000 lines have already been brought into service in London, in addition to the main junction switching centre known as the "mechanical tandem" exchange. The provision of 26 further exchanges, with a capacity of about 125,000 lines, is now in hand, and it is expected that equipment for about 50,000 lines will be added annually to the London automatic system until the conversion of the area, which at present has a total of about 650,000 working telephone stations, is completed and all the manual exchanges are removed. In order to effect plant economies it is proposed to provide auxiliary automatic tandem switching centres, and an automatic switching centre for "toll" circuits is also contemplated. It is anticipated that in seven years' time the number of automatic exchanges in the central London business area will have reached 100, leaving only five manual exchanges for subsequent conversion. This great grafting and transforming operation, one of the greatest and most complex ever attempted in the electrical field, has necessarily to be carried through while the London telephone organism continues to perform without interruption its function of providing service to all its subscribers by day and by night, and I can say quite definitely that the difficulties and mishaps which have so far been experienced have been considerably less than one was inclined to anticipate at its inception.

The Exchange System.—In this country as a whole we now have 163 automatic exchanges in operation in urban areas, with an aggregate capacity of about 300,000 lines (say 500,000 stations), and the planning and construction of 126 further exchanges is at present in hand. The manual system remains in use at the present moment at 487 exchanges having a capacity exceeding 300 lines, and at 3,790 smaller exchanges, serving, in all, about 1½ million stations; and exchange equipment of the automatic type capable of serving about 100,000 lines is being installed annually. At the present rate of development, one new public exchange and about 1,000 new telephones are installed for each working day throughout the year. Rural exchanges have, until quite recently, been entirely manual, but automatic equipment for exchanges serving small communities has now been designed on a basis which promises favourable economic results, and a start has been made with its

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installation; 60 such village automatic exchanges have been brought into operation, and about 110 more are in hand. The minimum exchange unit provides for 25 lines, and further units can be added up to a maximum of 200 lines. They are unattended; a maintenance man normally visits them about once a week for a general maintenance inspection. One important advantage of these small automatic exchanges is that they provide an all-night service, both locally and to the outer world, *via* junction lines to the nearest "parent" exchange. The expense of providing night attendance at village exchanges of the manual type is invariably out of all proportion to the insignificant number of night calls to be dealt with, and is generally prohibitive.

Development.—There is no question that the cost of elaborate and careful development study is richly repaid to such telephone administration as the Post Office, which sinks new capital of about 10 million pounds annually in the provision of additional plant to meet its growing requirements. The number of telephones in use in Great Britain is far smaller than it ought to be and, unfortunately, the same remark applies to the amount of use made of the service. The total traffic originated at exchanges having 300 lines and upwards only amounts to an average of 5.3 calls per line per day, which is much below the average in many other countries, and it shows no tendency to rise. Pouring more capital into the system would be putting the cart before the horse, and the additional interest and other annual charges thrown upon the accounts would soon convert the business into a losing one unless the public market for telephones and telephone service were at the same time correspondingly stimulated.

The Line.—It is to the study of the ideal wave-transmission line, and to the efforts made to realise its qualities in practice, that we owe nation-wide telephony and the striking progress which has recently been made towards telephony of world-wide range. In an underground cable with typical loading, say with an inductance of about 155 M per mile, the propagation speed will be about 16,000 km. per sec., giving for the mean speech frequency of about 1,200 cycles a wavelength of about 13,300 m. Heavier loading reduces the propagation speed and correspondingly reduces the number of coils per wavelength with a given spacing of coils; the cut-off point is correspondingly lowered. Lightening the loading increases the propagation speed and raises the cut-off point; a movement in this direction has been occasioned, at some sacrifice of attenuation, by recent demands for the provision of circuits capable of carrying the higher frequencies, up to 8,000 or more per sec., required for the effective transmission of music for radio broadcasting purposes, and of pictures.

So far as underground cables are concerned, the introduction of loading immediately increased the practicable range of telephone communication to three or four times its former limits. Its application is, however, both costly and troublesome. At intervals of about 2,000 yards an underground manhole chamber has to be substituted for a simple straight-through buried joint, in order to accommodate the sealed cast-iron pots in which the loading coils are fitted, and into and out of which the cables have to be led. Many hundreds of loading-coils have frequently to be accommodated in a single chamber in which much intricate jointing and plumbing work has to be done under trying conditions.

One would rejoice to find it possible to supersede inductive loading by some less formidable means of reducing the attenuation and the various forms of distortion which appear in unloaded underground cables. Methods by which this may eventually be accomplished, by compensating devices at the ends of the cables, are appearing and coming into use.

There remains the difficulty of compensating for attenuation as a whole, since the omission of loading-coils and the introduction of such devices as those already mentioned, all of which fritter away the energy of the speech wave, will have increased the attenuation factor of the circuit to eight or ten times that of the loaded cable line. In practice the amount of amplification that can be applied at any point in a telephone circuit is severely limited by the necessity for avoiding cross-talk between one circuit and another. The present system by which amplifying devices are used merely to restore the normal minimum energy of received speech to the normal level of transmitted speech, by an amplification averaging about 40 to 1 at each point, enables repeater stations to be installed 50 miles or more apart. The answer to the frequent question whether amplifying and distortion-correcting devices have sounded the death-knell of inductive loading is therefore decidedly in the negative, and it is clear that the art of cable manufacture will need to achieve another order of freedom from crosstalk, before an answer in the opposite sense can be given. This is not intended to imply that telephone-cable design and manufacture are in any sense open to the charge of being non-progressive

The four-wire system now in general use on the longest classes of circuit throughout the world permits the use of higher degrees of amplification, since crosstalk can be minimised by placing the outgoing transmitting pairs and the incoming receiving pairs of the cable in two separate groups, and by protecting the receiving group by electromagnetic and electrostatic shielding against interference from the comparatively strong currents of the transmitting group. No doubt the amplification used, and consequently the distances between repeater stations, could be further increased by the more effective shielding which would result from placing the transmitting and receiving sides of the circuits in entirely separate cables. This would, however, involve extensive rearrangement and reconstruction of existing systems, and, moreover, I think it is reasonable to hope that further improvements in cable construction, and in the two-wire system for circuits of equally light gauge, will eventually cause the four-wire circuit to disappear. It is essentially a double-line circuit, only one half of which is in effective use at one time, so that its doubled weight of copper contributes nothing to the transmission efficiency of the line.

The C.C.I.—In his presidential address delivered seven years ago, Mr. F. Gill called attention to the progress made in long-distance telephony in the United States and described the possibilities and the results of developing international communications on this side of the Atlantic to a corresponding degree. His remarks attracted widespread attention, and avowedly as a result of them France took the first step by inviting representatives of the telephone administrations of Western Europe to a conference. A further meeting was held in Paris, attended by representatives of 19 countries—Austria, Belgium, Czecho-Slovakia, Denmark, Finland, France, Germany, Great Britain, Holland, Hungary, Italy, Lettonia, Luxembourg, Norway, Poland, Spain, Sweden, Switzerland, and Jugo-Slavia—which definitely constituted itself as a standing advisory committee on international telephony (Comité Consultatif International), that was, at the end of the year 1925, definitely adopted by its natural protector the International Telegraph Union, and it now forms a permanent part of the structure of that great international association. Subsequent adhesions include the State Administrations of Albania, Dantzig, Esthonia, Lithuania, Mozambique, Portugal, Rumania, Russia, and Persia; and by a recent decision regarding the definition of membership the committee is now open to the adhesion of privately-owned telephone-operating administrations, under which provision Cuba and Mexico are now represented in its membership. The American Telephone and Telegraph Co., which has from the beginning helped the Committee in all possible ways most generously and effectively, has also been enabled by the new conditions of membership to join the Committee and thus add its great influence and prestige to its work in the cause of world telephony. We should warmly welcome also the appearance of Japan and of the British Dominions at the board. The surface of our globe now sets no limits to the range of the telephone, and the degree of progress made since the date of Mr. Gill's call to arms is, I think, something to warm his heart. I have had the privilege of attending, on behalf of this country, the plenary conferences of the committee from its beginnings, and I gladly testify to the fine spirit of co-operation and friendly concession which has been their characteristic throughout.

The Transmission Unit.—There is, however, one much-debated matter in which the committee has entirely failed to reach a common agreement, *i.e.*, the setting up of a unit in which to measure and express the attenuation accompanying the passage of an electromagnetic wave through any kind of transducer: open wires, cables, transformers, artificial networks, or any kind of apparatus combination. In its practical operation, the unit has merely to express numerically the ratio between the measured or calculated values of power, voltage, or current at the extremities of the part considered, and should express, not the ratio itself, but its logarithm; one can then simply add together the units representing the attenuation of each element of a combination in order to obtain the attenuation of the whole in the same units. This was common ground, but in the view of America, Great Britain, and two or three of the Continental nations, "common" logarithms to the base ten should be used and the measure should be that of power, while a majority in Europe desired to continue the use of "natural" logarithms, to the base e, and to apply the unit to the measurement of current or voltage. Europe and America each continue to use the system with which they have identified themselves. Great Britain is thus compelled to use both systems in its international relations, but has joined America in the adoption of the decimal system for its internal purposes.

It has been agreed that the Continental unit shall be known as the "Napier." One unit represents a ratio of current or voltage values $= e/1$; two units $= e^2/1$, and so on.

The basic unit of the decimal system has been called the "Bel." One unit represents the power ratio of 10 to 1; two units 100 to 1, &c.

The number of Napiers expressing the decrement of current or voltage, and the number of Bels expressing the decrement of real or apparent power in any circuit, differ from each other by only about 15 per cent. Both units are so large that practical units of one-tenth the logarithm have been introduced with the names "deci-napier" (e to the power of 0.1) and "decibel" (10 to the power of 0.1).

Radio.—A vast new field was opened up by the production of Hertzian waves and their utilisation for communication purposes. The stability of the service between Europe and America depends primarily upon the "long wave" channel originally installed, which operates on a carrier wave of 5,000 metres and radiates about 60 kW. There are also two short-wave channels, each using waves of the order of 16, 24, and 30 metres and radiating about 5 kW; this radiated power will shortly be increased to about 10 kW. The provision of a further short-wave channel is now in hand, and endeavours are being made to obtain the availability of a frequency in the crowded ether which will enable another long-wave channel to be established.

The radiated energies, both long-wave and short-wave, are very much more effective than similar amounts of energy used

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in ordinary broadcast practice. Before the energy is amplified for radio transmission the carrier frequency itself, which is the main power element, is filtered out. One of the side-bands, and the non-essential portions of the other, are also filtered out. There remains for amplification and transmission only that portion of one side-band which, after treatment at the receiving end, will reproduce speech frequencies between 300 and 2,500 periods per sec. In this way the effectiveness of each kilowatt of radiated energy is increased about six times. By the use of highly directional receiving antennæ a great increase in the ratio of signal strength to noise admittance is secured, and an effective improvement factor of about 100 is introduced. A further improvement in efficiency is obtained by locating the receiving stations in regions which have been found to be comparatively free from "atmospherics." With this object the British station has been located at Cupar, Scotland, 450 miles from London. It has been calculated that a further improvement factor of about 50 was obtained by shifting the receiving station from New York to Houlton. In the case of the short-wave channels the carrier waves and both side-bands are at present radiated, but these channels have the advantage of directional transmission, as well as reception.

Since the establishment of the London-New York system more than 25,000 successful conversations have been effected. The present traffic from all sources at each side averages about 45 calls per day, and the average duration of calls is about 6 minutes. The division of the traffic averages at this side :— 95 per cent. from the United States; 4 per cent. from Canada; and 1 per cent. from Cuba and Mexico. At the other side they get:—53 per cent. from Great Britain; 34 per cent. from France; 7½ per cent. from Germany; and 5½ per cent. from other European countries.

The classification of calls for the past three months between Great Britain and the Eastern States of America was 85 per cent. good and 15 per cent. fair. To the Western States and Canada the proportions were 76 per cent. good and 24 per cent. fair. The whole of the traffic handled was classified as 80 per cent. good, 19.7 per cent. fair, 0.2 per cent. poor, and 0.1 per cent. ineffective.

The second short-wave channel, brought into service in June last, has ensured full continuity of service at all times. When the third short-wave channel is provided at the end of this year there will be four channels available to take care of peak loads. The commercial data so far provided by the Anglo-American service is very far from representing the ultimate grade of service which will be obtained from such circuits.

"Privacy" in Radio-telephony.—Methods of imparting at least a high practical degree of privacy to the systems have been devised, and much close attention is being given to their development. I do not wish to suggest that secrecy in radio-telephony is yet in sight, in the sense that a competent outsider who is prepared to spend the necessary time and money in making arrangements to overhear conversations would never be successful, but I have little doubt that the system will ere long be equipped in such a way that a sustained and very elaborate attempt would be necessary in order to do so.

The Transatlantic Telephone Cable.—Notwithstanding the high degree of stability which has been attained on the existing group of transatlantic radio-telephone channels, the system would gain greatly by the addition of a submarine cable channel to the facilities available. While such a cable would be so costly that, by itself, its provision would be financially impracticable, the expense could be justified in the case of a cable which formed part of a larger system, to which it would impart the valuable element of assured continuity of service and unchallengeable secrecy, as well as adding to the total traffic-carrying capacity of the system. The American Telephone and Telegraph Co. has evolved a method of deep-sea telephone cable construction suitable for transatlantic operation. Work is now going forward actively on the development of a cable for connection between London and New York, and it is possible that this circuit will be available for service as early as 1932. The new cable will yield only one additional telephone channel, but it will be of maximum reliability, free from the variations charactertistic of radio circuits. It is probable that a superposed telegraph channel will also be obtainable. The new cable will be of the continuously loaded type, insulated with a new dielectric material known as "paragutta." It is made of similar raw materials, and its mechanical properties are similar to those of gutta-percha, but the combination and treatment of its constituents endow it with superior electrical properties.

The attenuation represented by the main cable link between Newfoundland and Ireland will be immensely great. The ratio of input to output power between the repeaters at its two ends will be about 10^{15}, or the equivalent of 150 decibels, for the high frequencies of the voice range; that is to say, the received power will be one thousand-million-millionth of the transmitted power, of about the same order as that experienced in the transatlantic radio circuits themselves.

The end repeaters will be single-way amplifiers and, in order to make two-way conversation possible, voice-operated switching mechanisms will be employed to control the direction of transmission. Thus the two persons engaged in conversation will, by the mere act of speaking, alternately switch the transmitting amplifiers into action at each end as required, and conversation will proceed in a perfectly natural manner.

Imperial Telephony.—The success of the transatlantic radio-telephone service has led to investigations into the possibilities of opening telephone services with the British Dominions. By the use of short waves an Anglo-Australian service of an experimental character has for some time been maintained, *via* the Post Office radio stations at Rugby and Baldock, working to the corresponding transmitting and receiving stations near Sydney. It is hoped that a regular commercial service will be inaugurated very soon, and it is anticipated that it will shortly be followed by services to South Africa, India, New Zealand, &c.

Maximum Distance Conversations and Power Used.—As an illustration of the fact that the dimensions of the earth's surface now set no bounds to the range of telephony, it may be of interest to mention a long-distance test conversation carried out in association with the United States by two of my officers who visited Sweden last year in connection with the opening of communication between that country and America by means of the Anglo-American radio-telephone channels of the Post Office.

The chain of lines set up and spoken over on that occasion ran from Stockholm, *via* Berlin and Amsterdam, to London, thence to New York by radio; it was extended stage by stage *via* Chicago and San Francisco to Los Angeles, and back by another channel to New York, thence once more to Chicago and back again to New York, with a final extension to the residence of one of the American Telephone and Telegraph Co.'s officials in New Jersey, from which a fair grade of conversation was exchanged with Stockholm.

The total length of the route traversed was about 14,000 miles. The aggregate length of copper conductor used on both sides of the Atlantic would be about 40,000 miles. The power-amplification factor introduced at the radio transmitting and receiving stations will thus vary widely around a mean value of about 10^{16} (10,000 billions). But the power loss made good by the repeaters on the wire-line portion of the circuit (11,000 miles) would be immensely greater. The transmission equivalent of the chains of circuits used would not be less than 2,400 decibels (240 Bels) and was probably a good deal more. The relationship of power sent to power received over a circuit of 240 Bels is a ratio of 1 to 10^{-240}.

It is permissible to think of the power which would be required to deliver currents of telephonic magnitude at the far end of such a circuit in the absence of repeaters. We start with an acoustic energy equal to about 10 microwatts delivered into the telephone transmitter by the voice of the speaker. To deliver even 1 microwatt at the far end of a circuit without intermediate amplification, the initial energy must have the inconceivable value of 10^{231} kilowatts. I believe that the power radiated by the sun is of the order of 4×10^{29} kilowatts, from which it appears that the number of suns required to feed our circuit with the necessary power would be 0.25×10^{202}. If we are inclined to accept Hubble's estimate that the maximum possible number of suns within the "world-line"—the limiting curve of space—is 2×10^{24}, it follows that the whole radiant energy of nature would fall immensely short of meeting the requirements. We should need to multiply nature by 10^{177}—one might say "approximately"! It seems evident that the invention of the telephone repeater has tended to simplify certain problems!

The Photo-Electric Cell.—The "photo-electric effect"—the ejection of an electron from an atom by the absorption of a quantum of light-ray energy—which has assumed so deep a significance in fundamental physics, has also provided a new and extremely useful tool for the more materialistic purposes of the communications engineer. By its aid a pulsing beam of light, no matter how complex or how rapid its variations may be, can be made to produce an exact counterpart of its modulations in the form of an electromagnetic wave.

The audience included not only a large gathering at the Institution's headquarters in London, but also similar gatherings at the local Centres at Manchester, Liverpool, Birmingham, Glasgow, Leeds, Newcastle, Cardiff, Southampton, and Portsmouth. Transmitters and loud-speakers were fitted at each place, so that speech from any point was reproduced at all other points. The occasion furnished a demonstration of an interesting innovation in the British trunk telephone service known as "conference communication," which facility is now available to the public, and enables conferences and discussions to be carried on by joint participants assembled at several different places. Speakers at all the Centres took part, and their speeches were clearly heard at all the other Centres.

The retiring president, Col. K. Edgcumbe, was in the chair during the early part of the meeting, and suggested that he was taking it on trust that he was speaking to a very much larger audience than was assembled in the lecture theatre, which, by the way, was a very crowded one.

Mr. W. B. WOODHOUSE proposed a vote of thanks to Col. Edgcumbe for his services as president during the past year, and said that, although he was retiring into the decent obscurity that was supposed to surround past-presidents, it was certain from his activity during the past year that Col. Edgcumbe would continue to take an active part in the future in the work of the Institution.

Capt. J. M. DONALDSON seconded the vote of thanks.

Col. EDGCUMBE, acknowledging the vote of thanks, which was carried with enthusiasm, remarked that he felt particularly grateful to the local Centres and sub-Centres, and wished to take that opportunity of thanking them all simultaneously for their hositality and kindness to him, an opportunity which he believed had not been afforded any previous retiring president. He felt that London had a great deal to learn from the local Centres about the way they conducted their affairs, and

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no doubt the local Centres could learn many things from London. Finally, he suggested that the Institution could give many other Institutions points in connection with the new decoration and lighting of the lecture theatre, which had been carried out during the summer recess. If there were any who did not like them, they must abuse the Council. Those who did like them, as he did, had to be grateful to Mr. C. C. Paterson and Mr. H. T. Young, who had devised the very successful scheme that had been carried out in conjunction with the architect.

The second novelty of the meeting was that the address was relayed to the Common Room, and a good number of those who were unable to obtain seats in the lecture theatre were able to listen in greater comfort there.

A cordial vote of thanks was passed to Col. Sir T. F. Purves at the conclusion of his address, on the motion of Mr. HARCOURT WILSON (at Manchester), seconded by Dr. MAGNUS MACLEAN (at Glasgow).

At the commencement of the meeting, the premiums awarded for papers read last session were presented.

Science and Electrical Engineering.

A Brief Survey of the Progress that has Resulted from Scientific Discoveries.

By PROF. E. W. MARCHANT, D.Sc., M.I.E.E.

(*Extracts from chairman's address delivered before the* MERSEY AND NORTH WALES (LIVERPOOL) CENTRE *of the* INSTITUTION OF ELECTRICAL ENGINEERS).

ALL scientific work of a fundamental nature should receive encouragement, for our knowledge of the fundamental nature of matter has undergone a profound change, and it does not seem beyond the realm of scientific possibility that some methods may be devised of setting electrons in motion by other methods than those with which we are familiar. No avenue by which more effective use can be made of our sources of energy should be left unexplored, and it is well to remember that most of the fundamental discoveries were the result of purely scientific investigation directed towards no practical end.

Communication.—We are so familiar with telephony that we perhaps fail to realise what a change it has made in our lives. Now that transatlantic telephony is an every day event, one can begin to see what an influence the telephone is likely to have on the language of the future. It may tend, perhaps, to counteract some of the excessive nationalism which has been such a depressing feature of European politics since the armistice.

Perhaps the most interesting observations made within recent months in wireless telegraphy have been those on wireless echoes of long delay. Stormer has noticed that in some cases an echo of a short-wave (length of about 30 metres) signal appeared to return to the sending station as long as three minutes after it had been sent out. Many observations have been made, the time interval ranging from several seconds up to over four minutes. Pederson has discussed possible explanations of this result. It cannot be a signal going round and round the earth continuously, for the attenuation of the wave would be too great; neither can it be explained by a lowered group velocity in the space above the Heaviside layer. The theory which meets the facts most successfully is that the wave penetrates the Heaviside layer, impinges on an electrical stream of charged particles emitted by the sun, and in some way is reflected back again to the earth. It is estimated that the length of path necessary to account for the delay in the echoes must be over 75 million kilometres, so that the signal must traverse nearly a quarter of the distance to the sun before returning once more. The theory is borne out by the fact that the echoes are only heard at times of magnetic storms, when it is known that sun spots are actively sending out streams of charged electrons. The results are of considerable interest scientifically, and, if confirmed, would appear to be the first records of signals sent out from the earth which have penetrated the upper regions of the atmosphere and returned again.

Engineering Materials.—Apart from the fundamental scientific discoveries which have proved of importance to the electrical engineering industry, many other sciences have been of great value to electrical engineers. Some of the most valuable scientific work that has been done within recent years is that on engineering materials. An alloy whch has enabled great developments to be made is nichrome wire, now used so universally in radiators and heaters of all descriptions.

Electric Heaters.—A series of experiments has been made recently in the Liverpool University laboratory by Mr. E. C. Walton on the causes of failure of such substances when used in cookers and boiling plates. The chief cause of failure is the presence of salt in any solution that may fall on the heated spiral. If such a heated spiral is immersed in water and heated it will last well, but as soon as salt is introduced electrolysis occurs, and the metal corrodes rapidly. Milk also causes the spiral to become heavily coated with a thick hard mass, which prevents the radiation of heat, and finally causes the failure of the element. Fatty substances, which do not contain salt, have very little effect on the heated spirals. The effect of electrolytic corrosion with a.c. is very much less than with d.c. In the case of one such wire electrolysis led to its breaking after only 20 minutes' immersion in a one per cent. salt solution when direct current was passed through it, whereas the same wire lasted nearly three hours when alternating current having the same r.m.s. value was used to heat it. In milk the same wire lasted 1 hour 55 mins. when direct current was passed through it, while with alternating current of the same r.m.s. value the wire showed comparatively little deterioration after 10 hours' immersion. This fact is of interest to engineers who are now changing over their systems from d.c. to a.c.

Distribution Networks.—One of the most important problems before the electricity supply engineer to-day is the economical design of the transmission network. In some cases the cost of the distributing network is four times as much as the cost of the generating plant, and the problem requires intensive study, since the cheapening of the cost of electricity depends as much on the reduction of the cost of distributing networks as on any other factor.

It is almost universal in South Africa for the supply systems to remote districts to consist of overhead lines. The distributing network is one of overhead wires supported on steel or ferro-concrete poles. Provided care is taken in the placing of the poles, their presence is almost unnoticed, and the saving in cost, as compared with underground cables, is very considerable. The problem of supplying electrical energy to the suburbs of towns like Johannesburg and Cape Town is much more difficult than it is to more concentrated towns in England, but with the development of the suburban areas with eight houses to the acre, which now surround all our big towns, it would seem to be inevitable that the distributing network must be carried overhead, unless the cost of electricity is to become prohibitive. It is possible also that for remote districts with a very bad load factor it may be possible to use iron wires instead of copper and aluminium ones. If this is done, it is important to have an exact knowledge of the behaviour of the metals which may be used as substitutes. Some figures indicative of the magnetic and electrical characteristics of such wires and the chemical composition and treatment that result in the best quality have recently been published by Mr. Walton, and it is to be hoped that similar results will be available for the other cheap materials giving the same detailed particulars of the mechanical and chemical properties of the substances to which they relate.

Lightning.—I was interested to find during my visit this summer to South Africa that the study of lightning and the nature of lightning discharges had been of no small service to the engineers in charge of the recently electrified Natal main railway line. During the summer the lightning storms in that district are very severe, and when electric traction was first installed the interference with its working by the almost continuous lightning storms threatened to jeopardise the success of the undertaking. The research engineers of the railway made a complete study of the nature of the breakdowns, and have been able to prevent undue interference, and have thus saved the electrified system from failure.

Measuring and Recording Apparatus.—Electrical engineering owes much of its progress to accurate measurement and observation. It is impossible to lay too much stress on the necessity for the accurate observation of electrical quantities, for it is notable that nearly all great discoveries have been based on effects which are relatively small. It is significant that big manufacturing undertakings all over the world have now established research laboratories on a very extended scale; they do not confine their activities to the testing of apparatus and materials used in the factories, but employ many people who are engaged in the study of pure science. Manufacturers are not necessarily philanthropists; they realise that such study pays. The universities have done a great deal in the training of men who can staff such laboratories (that is one of their primary functions), and they can best do that part of their work by encouraging their students to carry on "investigations" themselves. It is of the utmost importance that such studies should be encouraged, and that investigation and discovery should not be hampered by lack of means.

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New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

Cable Templates for Service Work.

A new item of service which has been initiated by Messrs. W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1, is a range of steel templates for use with their "Cablegrip" boxes. The idea of using such a template when stepping back distributor and service cables is ingenious and of considerable value as an aid to better and quicker service

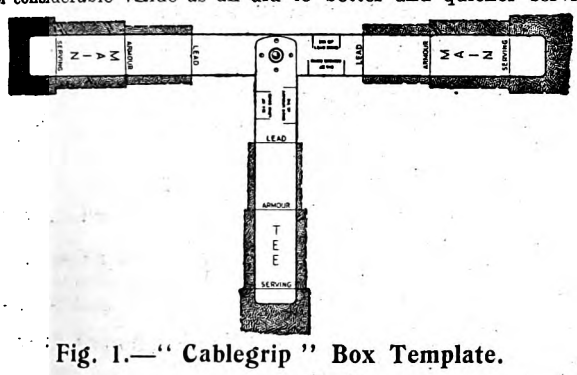

Fig. 1.—"Cablegrip" Box Template.

installations. On each "arm" of the template are engraved the respective markings for stepping back to the lead, armour, and serving of the cables, whilst the diameters of the armour grip and of the lead bond are also shown. The illustration, fig. 1, gives an idea of the template. A neat canvas case is supplied with each article sold.

New Surface Pyrometers.

In the manufacture of plastic articles in heated moulds, satisfactory results can only be secured if the temperature is maintained within definite limits, the permissible variation of temperature being dictated by the nature of the material being moulded. The surface pyrometers, models 33 and 34, figs. 2 and 3, recently introduced by the Cambridge Instrument Co., Ltd., 45, Grosvenor Place, S.W.1, are claimed to provide accurate and convenient means for quickly determining the inside surface temperatures of bakelite and other moulds, and of the heated surfaces of mould presses. Each instrument comprises a sensitive thermo-element connected by a short length of flexible steel-armoured leads to a portable indicator calibrated to read directly in degrees of temperature. The thermo-element is protected by a cylindrical metal sheath which, when the thermo-couple is applied to the hot surface, is forced back against a spring, so as to bring the end of the loop into contact with the surface. When in use the thermo-couple is held in one hand and applied to the heated

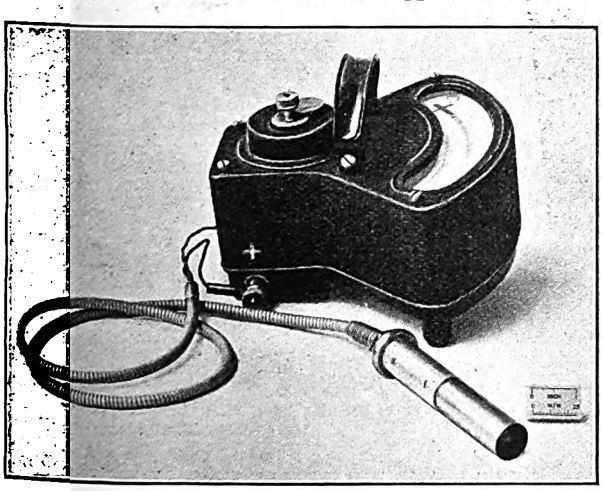

Fig. 2.—"Cambridge" Surface Pyrometer; No. 33 Model.

surface, while the indicator is held in the other. The instrument gives a steady reading almost instantaneously. In model 33 the thermo-couple is a thin flat strip formed into a small loop, and the sheath is directly attached to the end of the flexible leads. In model 34 the thermo-couple is of wire form, flattened at the thermo-junction to form a small thin plate, and the thermo-couple sheath is pivoted to the end of a hollow metal rod, which facilitates the application of the thermo-couple to surfaces which are not easily accessible. In addition to their usefulness in determining surface temperatures of moulds, the instruments have also a wide field of utility in other manufacturing operations where it is necessary to ascertain surface temperatures with rapidity and accuracy. They may be used, for example, as insertion pyro-

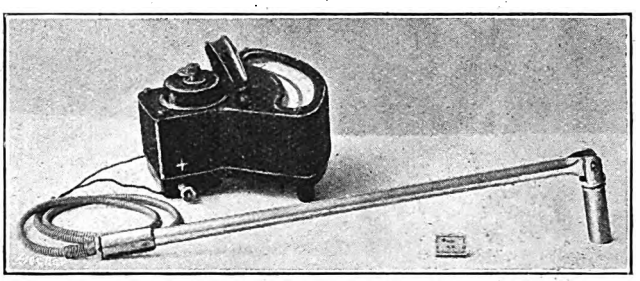

Fig. 3.—Model 34 "Cambridge" Surface Pyrometer.

meters for testing the temperature of field coils, &c., or as surface pyrometers for flat or curved surfaces, as well as bearings, motor and generator parts, low-voltage busbars, high-voltage cables, and other parts susceptible to a critical rise in temperature.

New House-lighting Sets.

Hitherto mainly occupied with the manufacture of motor bicycles, Douglas Motors, Ltd., of Kingswood, Bristol, have recently taken up the construction of electric lighting and power sets, fig. 4, for installation in country houses and small factories. The sets are being constructed in two main sizes, with outputs of, respectively, 1,750 and 1,000 watts, and each comprises one of the firm's horizontally-opposed twin-cylinder air-cooled engines of the type which has for years been exclusively used on the Douglas motor cycles. The engine is directly coupled to a shunt-wound battery-charging-type generator capable of developing its rated output con-

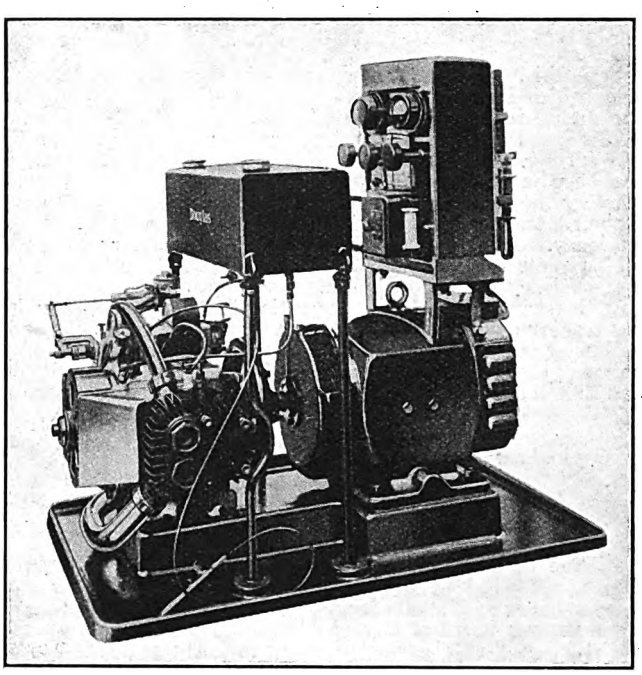

Fig. 4.—"Douglas" House-lighting Set.

tinuously for six hours, with a temperature rise of only 40° C. Special windings are fitted in the generator, which, coupled with a contact on the charge and discharge switch, enable it to be run as a motor and exert sufficient torque to start up the engine. The switchboard is conveniently mounted above the motor, and consists of an enamelled-slate slab contained in an aluminium frame as illustrated above.

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Correspondence.

Correspondents should forward their communications as early as possible. *No letter can be published unless we have the writer's name and address in our possession.*

Thermal Storage Water Heaters.

I have read Mr. D. W. Low's further letter on the above subject very carefully and, whilst I respect his opinions, I think that the matter should certainly be regarded as *sub judice* until more complete evidence is available. If the figures given by Mr. Low in Table 2 are to be considered as in any way typical of English requirements and as comparable with the Zurich records, then one is required to believe that the English household of four or six persons would need approximately three times as much hot water per day as a similar Swiss household. My experience is that the standard of living in Switzerland is not less than ours, and therefore I cannot

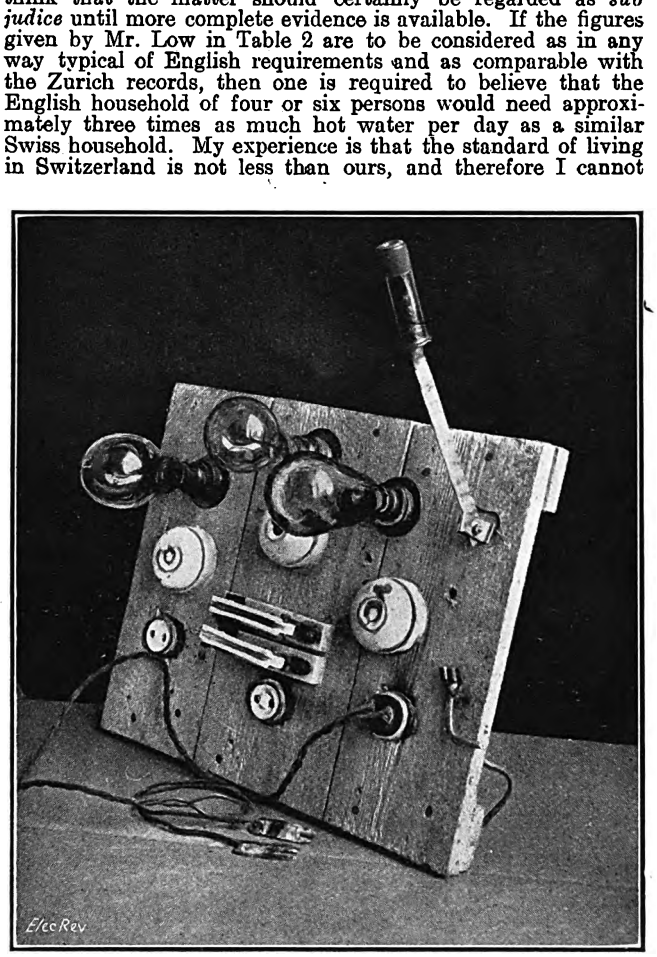

Fig. 1.—A Home-made Charging Board.

believe this. A possible explanation is that the installations from which Mr. Low's figures were taken differ in some important manner from those in Zurich. I would like to know if this could be the case, and perhaps Mr. Low will agree to give further particulars regarding the length of time the tanks had been in service before the records were commenced, and whether the large tanks are converted installations or specially designed storage tanks with proper lagging, running at high efficiency. There is also the possibility that the tanks were too large for the requirements of the households, and, if so, a low efficiency is to be expected.

With regard to Mr. Low's suggestion that I was mistaken in my reading of his letter when I asked why tanks of 90 or 100 gallons were necessary in houses of five or six rooms, I can only say that those are the figures which appeared in his letter and that the mistake is not on my side.

L. G. A. Sims, M.Sc.(Eng.).

Birmingham, *October 21st*, 1929.

All-Electric Houses.

I have been interested in the article by Prof. S. Parker Smith, published in your October 18th issue, as we have a large number of "all-electric" houses in this borough, and I have not yet heard of any of our consumers who have made their houses "all electric" desiring to go back to the use of coal or gas.

Like Dr. Parker Smith, we have found that flexible cable troubles have been largely overcome by the use of stouter cords, and the standard 15-amp. plug we use is arranged to take a 5-amp. plug in addition.

The following particulars of costs for two families in houses of a different type and size from those referred to in the above-named article will, no doubt, be of interest. It should be borne in mind that the period covered by the year ended September last includes the exceptionally cold weather experienced last winter.

For Year Ended September, 1929.

Example "A."—Number in family—3 adults.

Consumption for lighting, heating, cooking, water heating, wireless, &c., 4,930 units, total	£18 0 0
Average price per unit	0.876d.
Hire charges of apparatus	£2 16 0
Average price per unit, including hire of apparatus	1.013d.

Example "B."—Number in family—6 adults, 2 children.

Consumption for lighting, heating, cooking, water heating, &c., 7,120 units, total ...	£24 4 4
Average price per unit	0.816d.
Hire charges of apparatus	£3 18 0
Average price per unit, including hire of apparatus	0.948d.

A. H. Shaw,
Borough Electrical Engineer.

Ilford, *October 23rd*, 1929.

A Problem in Testing.

The problem in testing set by "A.T.S." in your issue of October 4th cannot be solved by any short cut method, but it will be found that the working is much simplified by using a symbol (say r) throughout the working to indicate the value of the resistance of AB in ohms per mile, since in this way excessive numerical multiplication is avoided, quite a number of terms vanishing. In the final equation, which is a quadratic, only one of the roots of which is valid, the numerical value of r, which, according to the data, is $230 \div 25$, may then be inserted. The answer is AC=18.84 miles.

In an actual test, by simply making another measurement, namely, resistance between A, and earth (B insulated), the distance AC may be obtained at once to a much greater degree of accuracy.

A. Morris Thomas, B.Sc.

Acton, *October 23rd*, 1929.

[Messrs. E. P. Elwin (Blackheath) and H. Shackleton (Manchester) have written pointing out that the distance is approximately 18.83 miles and not 19 miles as given by one correspondent in the Electrical Review for October 18th, p. 680.—Eds. Elec. Rev.]

Amateur Wiring.

I am enclosing two photographs (which are reproduced on this page) of a "charging board" I recently found in a private house, which was being changed over from d.c. to a.c. As an example of amateur wiring I think it is unique. Unfortunately, the photographs do not do justice to the

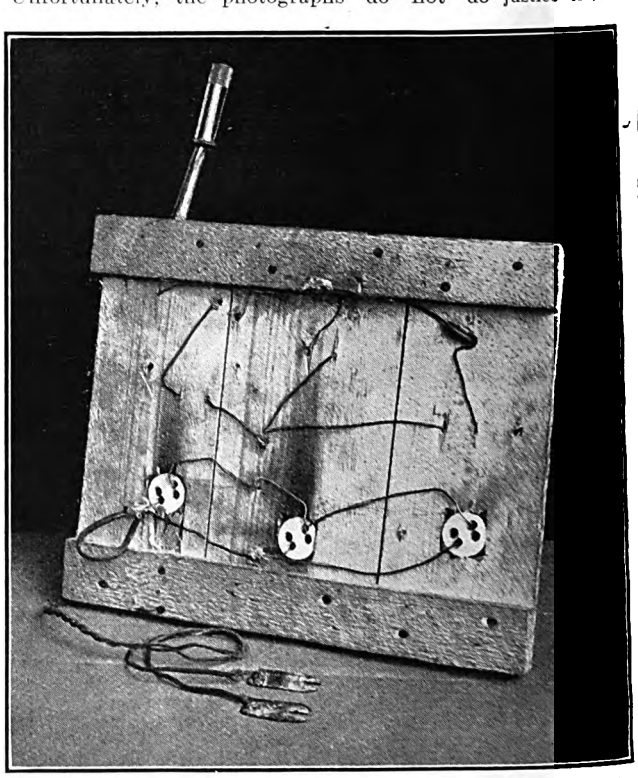

Fig. 2.—Reverse View of the Board.

original. It will be observed that the woodwork is made from a packing-case, while the "main switch" was originally a bicycle air pump (fig. 1) which has been flattened out by a hammer. The wiring on the back (fig. 2) is of bare copper and the whole was found screwed to a brick wall!

Reg. H. Rawll, A.M.I.E.E., A.M.I.Mech.E.

Birmingham, *October 25th*, 1929.

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Electric Boiling Plates.

Your leader under the heading of "Electric Cooking and Water Heating" on page 630 of your issue of the 18th inst., interests us greatly, but we feel that you are unduly pessimistic in the comparison you make between gas and electricity. You state that "the simpler, efficient, and cheap means of obtaining small quantities of hot water on the ordinary gas stove cannot be exactly emulated in connection with electric cooking . . ."

We feel that, in arriving at this conclusion, you have overlooked the existence of the "Superspeed" boiling plate, which we manufacture.

This plate, which is a low-voltage transformer-operated device, was exhibited first at the I.M.E.A. Convention Exhibition at Bath, 1928. Since that date its popularity has gradually increased, until to-day our works are dispatching regularly 18 per day to various supply authorities. Of these, 8 per day are being supplied, incorporated in our standard cookers, to the largest electrical utility company in the Midlands, who have standardised on this boiling plate.

Comparative Tests on Boiling Plate, using 5-in. Diameter Pressed Aluminium Saucepan of Standard Type.

Type of plate.	Loading.	Temp. rise °F.	½-Pint. Time min. sec.	½-Pint. Consumption.	½-Pint. Efficiency %	1-Pint. Time min. sec.	1-Pint. Consumption.	1-Pint. Efficiency %
Enclosed cement-filled ...	1,600 W.	158	6 50	182 Wh.	16.1	8 45	233 Wh.	24.9
Gas ring	15 cu. ft./h. N.T.P.	158	2 52	0 717 cu. ft.	26	4 48	1.203 cu. ft.	34.5
"Superspeed"	2,000 W.	156	2 48	84 Wh.	34.4	4 05	136 Wh.	47.4

We refer to these figures to show that, whilst the extra price of this plate must retard its general adoption, there are supply engineers in this country with sufficient foresight to appreciate its attributes.

A comparison of boiling times obtained with a gas ring, an enclosed cement-filled plate, and a "Superspeed" may be of interest to your readers and we accordingly quote them.

It should be borne in mind when comparing these figures that the gas ring was new and of the latest design, and that after about one month's use it will lose about 20 per cent. of its pristine output, whereas an electric boiling plate retains its efficiency throughout its life.

We trust that in justice to the industry you will publish these figures, lest our friends with gas interests seize upon your remarks and broadcast them to the detriment of electric cookery.

H. Bickell, A.M.I.E.E.,
for REVO ELECTRIC CO., LTD.

Tipton, Staffs., *October 25th*, 1929.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken

1928.

7,030. "Electric traction for railways." S. M. Rutnagur. September 24th, 1928. (319,885.)

9,797. "Electrical accumulators and storage batteries." D. E. Washington. March 31st, 1928. (320,026.)

10,295. "Process and apparatus for the electrolytic preparation of antiseptic and cicatrising solutions." F. Chevrier and M. L. Grille. April 4th, 1928. (320,096.)

10,417. "Electric piston motors." P. Frenell. April 5th, 1928. (320,097.)

11,493. "Electromagnetic cut-outs, switches, and the like." A. H. Midgley. April 18th, 1928. (320,045.)

12,500. "Alternating-current supply systems." Ganz-Fele Villamossagi Reszvenytarsasag. May 3rd, 1927. (289,834.)

12,624. "High-frequency oscillation generators." C. Lorenz Akt. Ges. August 3rd, 1927. (294,977.)

13,338. "Carbon microphones." Siemens & Halske Akt. Ges. May 7th, 1927. (290,167.)

15,458. "Electric gas-discharge rectifiers." M-O Valve Co., Ltd., and J. W. Ryde. May 25th, 1928. (320,031.)

15,620. "Means for securing in position the electric conductors of alarm circuits." H. J. Tibbles, and Rely-A-Bell Burglar & Fire Alarm Co., Ltd. May 29th, 1928. (320,051.)

15,835. "Motor control system." M. Latour. May 30th, 1928. (320,032.)

15,930. "Telegraphs for use in ships, power stations, and the like." A. Robinson & Co., Ltd., J. F. Gill, and J. N. Chaviara. May 31st, 1928. (320,078.)

18,829. "Sound reproducing or transmitting instruments." S. G. Brown. June 28th, 1928. (320,081.)

18,893. "Automatic control of turbo-alternators." Imperial Chemical Industries, Ltd., and T. R. Warren. June 29th, 1928. (320,038.)

18,928. "Adjustable magnet devices." British Thomson-Houston Co., Ltd. July 29th, 1927. (294,642.)

19,012. "Electric switches of the tumbler type." J. A. Crabtree. June 30th, 1928. (320,039.)

19,065. "Circuit arrangement for telephone installations." Siemens and Halske Akt. Ges. March 3rd, 1928. (307,040.)

19,135 "Interconnecting arrangements for use in telephone systems." Automatic Telephone Manufacturing Co., Ltd., F. Kessler and A. G. Forster. July 2nd, 1928. (320,061.)

19,166. "Vacuum switches for dealing with high electric outputs." Siemens-Schuckertwerke Akt. Ges. July 14th, 1927. (293,862.)

19,195. "Line source of light varying with applied electrical energy for observing or recording rapid variations in current or potential." F. A. Lindemann. July 3rd, 1928. (320,070.)

19,261. "Sealing-devices for the covers of transformer tanks and other vessels." A. R. Dunton and Associated Electrical Industries, Ltd. July 3rd, 1928. (320,073.)

19,270. "Formers for electric coils." Igranic Electric Co., Ltd., and G. F. Dandridge. July 3rd, 1928. (320,075.)

19,280. "Telephone instruments." Siemens Bros. & Co., Ltd., E. A. Petithory and F. Baker. July 3rd, 1928. (320,086.)

19,361. "Secrecy systems for signalling." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). July 4th, 1928. (320,091.)

19,419. "Geared electromotors for driving manicuring apparatus or the like." Siemens-Schuckertwerke Akt. Ges. June 4th, 1928. (312,980.)

19,648. "Synchronism-indicating means." British Thomson-Houston Co., Ltd. July 22nd, 1927. (294,241.)

19,695. "Remote-control systems." Associated Telephone & Telegraph Co. August 6th, 1927. (295,017.)

19,696. "Electric remote-control systems." Associated Telephone & Telegraph Co. August 3rd, 1927. (294,980.)

19,697. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., W. O. Passmore and C. E. Beale. July 6th, 1928. (320,114.)

19,740. "Manufacture of electric commutators and similar current-interrupting devices." Klaxon, Ltd., and J. F. Monnot. July 6th, 1928. (320,117.)

19,803. "Electrical impedance networks." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). July 7th, 1928. (320,121.)

19,804. "Motor-vehicle electric lamps." J. Lucas, Ltd., O. Lucas and W. H. Egginton. July 7th, 1928 (Cognate application 21,097/28.) (320,122.)

20,114. "Telephone systems." Associated Telephone & Telegraph Co. October 19th, 1927. (299,007.)

20,247. "Electric switches." British Thomson-Houston Co., Ltd. July 11th, 1927. (293,776.)

24,853. "Measurement of the temperature of electric cables." Callender's Cable & Construction Co., Ltd., and L. G. Brazier. August 29th, 1928. (320,193.)

25,100. "Acoustic films and their method of manufacture." Soc. des Etablissements Gaumont. September 25th, 1927. (297,733.)

25,173. "Sound-producers such as loud-speakers." C. M. de C. de la Bourdonnais (Prince de Mahe). September 1st, 1928. (320,198.)

25,488. "Means for supervising or controlling electrical fault indicating and protective devices." Siemens-Schuckertwerke Akt. Ges. September 26th, 1927. (297,734.)

25,905. "Thermal electric switches." G. Wilkinson. September 10th, 1928. (320,206.)

26,529. "Radio reception." A. D. S. Rice. September 15th, 1928. (320,212.)

26,647. "Electric resistance furnace for the thermal treatment of metals and other substances." Infra. September 29th, 1927. (297,826.)

27,587. "Quick-make and/or break switches." H. B. Prentice. September 26th, 1928. (320,219.)

28,363. "Electric imitation fires." Edison Swan Electric Co., Ltd., and W. E. Hankins October 3rd, 1928. (320,224.)

28,805. "Connectors, or termina's for making a positive metallic connection between high or low tension electric cable and terminal post." T. R. Christopher. October 8th, 1928. (320,227.)

29,452. "Combined condenser and grid-leak for wireless receiving apparatus." Brandes, Ltd., and T. D. Ward-Miller. October 12th, 1928. (320,235.)

30,194. "Thermionic valves or electron discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. July 11th, 1928. (315,295.)

30,205. "Elevator safety appliance." Waygood-Otis, Ltd. November 4th, 1927. (299,874.)

30,709. "Quick-acting switches for heavy direct currents." Siemens-Schuckertwerke Akt. Ges. October 28th, 1927. (299,461.)

30,809. "Electron-discharge devices." F. Rother. November 14th, 1927. (300,547.)

31,684. "Electric traction for railways." S. M. Rutnagur. October 31st, 1928. (Addition to 316,666.) (320,253.)

32,910. "Device for correcting radiogoniometric indications on board a ship." Soc. Maritime Nationale. June 22nd, 1928. (314,039.)

32,917. "Devices for preventing the tilting movement of the bows of current-collectors." F. Szalay. August 4th, 1928 (Addition to 299,779.) (316,856.)

33,632. "Mercury-vapour apparatus." Hewittic Soc. Anon January 17th, 1928. (Addition to 249,121 and 264,837.) (304,228.)

37,764. "Means for operating polyphase motors from a single-phase source." M. C. Spencer. December 21st, 1928. (320,288.)

1929.

1,515. "Electrical control devices responsive to light." Associated Electrical Industries, Ltd. January 16th, 1928. (304,211.)

21,854. "Protective arrangements for electric power lines or the like." R. O. Kapp and C. G. Carrothers. June 21st, 1928. (Cognate application, 21,855/29.) (Divided application on 317,874.) (320,067.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from October 23rd:—

Dyalmo. No. 505,352. Class 6. Electric lighting power and ignition machines and parts thereof for motor vehicles and cycles.—M.L. Magneto Syndicate, Ltd., Lower Ford Street, Coventry.

Ideal (lettering and design). No. 501,395. Class 8. Radio-telephonic apparatus and parts thereof.—Electradio Co., Ltd., 25, Westbourne Grove, W.2.

Camel Accumulator, Goes for Weeks without a Charge (lettering and design). No. 503,954. Class 8. Electric accumulators (not for medical purposes).—M. Marks, trading as the Camberwell Supply Stores, 185, Camberwell Road, S.E.5.

Symentis, No. 503,724, and Mastol, No. 503,725. Class 50. Electrical insulating material, plastic compositions of phenol and formaldehyde for use as binding agents for electrical insulating materials, and panels.—W. A. Jones and H. Allaun, 74 Blackfriars, Salford.

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

BATH.—Technical college, secondary school, training college, &c. (£172,860), for the borough E.C.; director of education.

BIRKENHEAD.—Baths; borough surveyor.

BOLTON.—Libraries, Leverhulme Park, Deane and Heaton; wash-houses, Rothwell Street; borough engineer.

BRADFORD.—Four ward blocks, main corridor, and administration block, Royal Infirmary, Duckworth Lane; W. J. Morley & Son, architects, 269, Swan Arcade.

BRAINTREE.—High-lift centrifugal pumping plant, electrically driven, for the Bocking and Great Coggshall main drainage schemes, for the R.D.C.; J. D. Haworth, consulting engineer, 3, Central Buildings, Westminster (returnable deposit of £5).

BRIGHTON. — Development, Hollingbury Copse estate; Simpson, Cullingford & Co., 65, Bishopsgate, E.C.

BROMLEY (KENT).—Block of 10 shops, Widmore Road; A. Frampton. Houses (16), Farnaby Road; Fleming, Reynolds & Co.

CHADWELL HEATH.—Development, Wangey Hall estate; F. Smith, architect.

CHELL (STAFFS.).—Estate development, off High Lane; Chatterley-Whitfield Colliery Co.

CIPPENHAM (BUCKS.).—Development of Iona estate, with 2,000 houses; F. Smith. School (£16,000), for Bucks. E.C.; director of education, Aylesbury. Church (£16,000); incumbent.

DERBY.—Public baths, for the T.C.; C. H. Aslin, borough architect, Babington Lane (deposit of £1 1s.). Nurses' home (£17,000), Mental Hospital; clerk.

DUNDEE.—Fire station, for northern district; city architect.

EDINBURGH.—Engineering research rooms, lecture rooms, laboratories and workshops (£50,000), and geological department (£50,000), for University; Lorimer and Matthew, architects. Hall, gymnasium, and class rooms at Portobello secondary school (£7,000); master of works, Education Authority. Public wash-house, for Corporation (£12,000); city architect.

GRAVESEND.—Houses (40), King's Drive; borough engineer.

GUILDFORD.—Estate development, Ganghill Copse; A. C. Burlingham.

HARPENDEN.—School, for Herts. E.C.; director of education, Hertford.

HARROGATE.—Conversion of Victoria Baths into municipal offices (£35,000); town clerk.

HASTINGS.—Rebuilding station and extensions (£340,000), for the Southern Railway Co.; engineer.

HERNE BAY.—Hospital, for the Queen Victoria Memorial Cottage Hospital Committee; T. B. Cornfoot, hon. secretary.

HORSHAM.—Fire station and living quarters, Horsham Park, for the U.D.C.; C. G. Atkinson, Council Offices (returnable deposit of £2 2s.).

HOUGHTON-LE-SPRING.—School (440 places), for Durham County E.C.; F. Willey, architect, 34, Old Elvet, Durham.

INVERNESS.—Shop and warehouse (£8,000), for Boots' Pure Drug Co., Ltd.; the manager.

KINGSWINFORD.—Housing scheme (50), Pensnett, for the R.D.C.; W. Meredith, surveyor, Wordsley, Stourbridge (returnable deposit of £2 2s.).

LEWES.—Extensions, county hall (£25,000), for East Sussex C.C.; county architect.

LONDON (EAST HAM, E.).—Alterations, Empire Cinema, Barking Road; W. S. Trent, architect.

(WAPPING, E.).—Tenements, Wapping estate (£32,482); Canonbury Construction Co., Ltd.

(POPLAR, E.).—Libraries at Bromley and North Bow; borough engineer.

(ILFORD, E.).—Houses (53), Middleton Gardens; Suburban Developments (London), Ltd. Houses (47), Widdecombe Gardens; T. Anders. Bank, Cranbrook Road; G. Hamblyn Fox. Warehouse, High Road; Cakebread, Robey & Co. Ltd.

(BLACKFRIARS, E.C.).—Buildings, Bankside; Beck & Pollitzer, 133, Queen Victoria Street. Alterations, The Ring, Blackfriars Road; Robert Cromie, architect.

(HOXTON, N.).—Tenements, Whitmore estate (£24,262); Rowley Bros., Ltd., Tottenham.

LONDON (*continued.*)

(ST. PANCRAS, N.W.).—Housing scheme, Camden Road (£21,000); borough engineer.

(WOOLWICH, S.E.).—Casualty ward and out-patients' department, Plumstead and District Hospital, for the Board of Guardians; Whincop & Channer, architects, 47, Thomas Street.

(DEPTFORD, S.E.).—Storm-water pumping station (£230,000); L.C.C. engineer.

(WANDSWORTH, S.W.).—Block of flats, for the B.C., Garratt Lane, Merton Road, and Acuba Road; G. L. Elkington, architect. Municipal buildings, adjoining town hall; Edward Hunt and G. L. Elkington, architects.

(FULHAM, S.W.).—Tenements, Harwood Road (£31,986). Lole & Co., Ltd., Wandsworth.

(CLAPHAM, S.W.).—Highways depôt, Manor Street; Wandsworth borough engineer. Additions, Cleeves factory, South Side; Yates, Sturdy & Usher.

(CHELSEA, S.W.).—Enlargement, Lots Road pumping station (£250,000); L.C.C. engineer.

(BATTERSEA, S.W.).—Reconstruction, Globe Cinema, Northcote Road; Globe Cinema, Ltd.

MANCHESTER.—Conversion of premises into café and restaurant, Peter Street, South Street, and Bootle Street, for Miss Grove; J. R. Aspden & Sons, 250, Great Western Street, builders. Erection of cinema (2,000 seats), at the corner of Dudley Road, Whalley Range, for T. Royle; J. Knight, architect, 5, Cross Street.

MORECAMBE.—Extensions, works, stores, and garage; Souplex, Ltd.

NEWCASTLE-ON-TYNE.—Further housing scheme (3,000); city architect.

NEWPORT (I. OF W.).—Extensions, County Hall; Isle of Wight C.C.

OLDHAM.—Premises, with heating and electric lighting work, Market Place, for Freeman, Hardy & Willis, Ltd.; J. England, 12, Clegg Street Premises, Market Place, for Montague Burton, Ltd.; H. Wilson, 81, North Lane, Roundhay, Leeds.

PETERBOROUGH.—Re-erection of premises, Park Road, for the Co-operative Society (£15,000); secretary.

PORTSMOUTH.—Factory, Basin Street, Portsea; Portsea Island Co-operative Society, Ltd. Business premises, London Road and Stubbington Avenue; Mr. Melaine. Business premises and flats, Copnor Road; C. W. Stigant.

RADCLIFFE.—Senior central school, Peel Park, for the E.C.

RAWDON (YORKS.).—Extensions to works, for W. B. Cartwright, Ltd.

REDCAR.—Housing scheme (60), for the T.C.; borough surveyor.

REIGATE.—Development of estate, Sliphatch Lane; Hayden and Randall.

SHIPLEY (YORKS.).—Employment exchange; H.M. Office of Works, King Charles Street, London, S.W. (deposit £1 1s.).

SOUTHPORT.—Bazaar premises, Chapel Street, for F. W. Woolworth & Co., Ltd., Kingsway, London.

STOCKPORT.—Billiard hall, shops, &c., Buxton Road and Southwood Road, Davenport; C. Hartley, 128, Buxton Road, Hazel Grove.

STOCKTON-ON-TEES.—Housing scheme (384), Primrose Hill estate; G. P. Stainsley, architect, 25, High Street (deposit £2 2s.).

STOKE-ON-TRENT.—Houses (62), Swan Lane site; city engineer.

STOURBRIDGE.—Factory extensions, Franchise Street, for Dutfield & Quayle. Houses (118), for the T.C.; Eadie Towers & Co., builders, Wolverhampton.

TWICKENHAM.—Houses (104) and flats (48), for the T.C. at Fifth and Sixth Cross Roads; G. R. King, borough engineer (returnable deposit of £2 2s.).

WALLSEND.—Extension of Stephenson Memorial School; P. Brown & Sons, architects.

WELWYN GARDEN CITY.—Two schools, for Herts. E.C. director of education, Hertford.

WEST BROMWICH.—Housing scheme (56), near Oak Lane A. D. Greatorex, borough engineer.

WISHAW.—Garage, offices, and canteen, for Stewart and McDonald, omnibus proprietors; the manager.

WREXHAM.—Institute, Llay Main; F. A. Roberts, architects, Earl Chambers, Mold (deposit of £3 3s.).

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The ELECTRICAL REVIEW

FOUNDED 1872

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The Limits of Co-operation.

IN his presidential address to the members of the Institute of Fuel, Sir David Milne-Watson refers to the present position of electricity supply. His comments are those of one who, though outside electrical engineering, may nevertheless be expected to entertain an interest in its developments that is not entirely academic. He gives credit to the electrical industry for its tendency to make a trial of new paths, as indicated by the national scheme from which he thinks certain benefits are already being obtained. In his warning that the millennium is not to be expected merely by the centralisation of our generating resources, he only repeats what responsible electrical engineers have emphasised from the beginning, since it is clear that the grid can do no more than provide a framework wherein supply authorities must work out their own destiny. As might be expected he touches upon the relative thermal inefficiency of electricity under present methods of generation. While the thermal value obtained at the consumers' terminals does not differ greatly from that of gas *per se*, the manufacture of coke as a principal by-product places gas from the thermal stand-point in the superior position claimed by Sir David. Apart, however, from the facts that the generation of electricity has not by any means reached its final phase, and that there is an obligation on engineers to strive after the highest heat efficiencies obtainable, we submit that our social and industrial life has other goals than thermal economy. The community is the final arbiter and may consider that certain advantages are worth the definite sacrifice of heat units; it may be trusted to express its preferences through the usual commercial channels. Sailing ships were great savers of heat energy; yet the number of full-rigged ships and barques—among the loveliest things man has ever created—used on deep-sea service is now little more than a score, and possibly within a decade none will survive for ocean trade. Considerable economies are being made in the use of fuel on steamers, but such economies are small compared with the increase in consumption due to the higher speeds and greater tonnage which are requisite for modern transocean needs.

Sir David makes the sweeping statement, with which we are quite unable to agree, that cheap hydro-electric power can only be secured at the expense of the beauty

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of the countryside. On the other hand, we would wish to support, within limits, the plea with which he ends his address. He appeals for co-ordination of effort and for a free and full exchange of information on technical, commercial, and economic fuel questions.

Electricity and gas have in common many advantages over other agents in the promotion of industrial efficiency and domestic comfort. They both have the merits of convenience, cleanliness, flexibility, and saving in storage, to name only a few of the incidentals that make for overall economy. It is, we may admit, largely due to gas propaganda that these factors in net cost are now widely recognised. The educational effect of the two industries in promoting a higher standard of living is of the utmost value to both, and we think more electricity is used than would be the case if gas had not spared us much pioneering effort. We may recall the case of Chicago, where a *per capita* consumption of electricity many times that of London is compatible with a *per capita* gas consumption about equivalent to that of London. Indeed, the history of the two industries shows that mutual emulation has been to the benefit of both as well as of the consumer.

We do not expect to see the gas industry moribund, even if this were desirable. The output of gas after 117 years still increases at the rate of three per cent. per annum, and it is highly probable that the share of this increase that would otherwise have come to electricity, at the moment, is less than the proportion of the ten per cent. per annum electrical increase that is due to the stimulus of gas. In the face of such virility in old age it seems strange to reflect that, in the Electric Lighting Act of 1882, provision was made to relieve gas undertakings of their obligation to supply when faced with electrical competition. We have not heard of any instances in which advantage was taken of this clause of the Act by the gas industry, which with commendable activity proceeded to seek new fields to exploit.

Although electricity and gas thus occupy common ground as beneficient public services, their sphere of interworking is severely restricted in practice. Electric gaslighters have been invented, and it is feasible to consider the use of small gas engines to enable a village distribution scheme to be started without undue expenditure on generating plant, with the intent to provide a nucleus load by the time a bulk supply is available. Also electrical engineers should logically advocate the use of gas where electricity is not obtainable. We should like, however, to make it quite clear that in our view there can be no question of delimitation of territory between the two industries. The arguments for the use of gas provide arguments *a fortiori* in favour of electricity. Electrical engineers will endeavour to secure whatever business they can from gas undertakings as well as develop new fields of their own. Meanwhile the gas interests will continue to increase output and to break new ground for the benefit of electricity, as quickly as the latter industry is able to absorb the stimulated demand.

In short, the most satisfactory form of co-operation between the two industries for the public good lies in healthy competition, each aiming to give a service of maximum efficiency with the minimum of accident.

The Hams Hall Power Station.

In the light of modern practice and the conversations which led up to and surround the 1926 Electricity (Supply) Act, the new power station of the City of Birmingham Corporation at Hams Hall, which was to be opened on Wednesday this week by the Duke and Duchess of York, and which we describe fully elsewhere in this issue, may be said to "break the rules" in two respects; it is a cooling-tower station, and its generating frequency is 25 cycles. But there seems to be justification for the step taken in each case. In consideration of the first point, the anticipated maximum overall theoretical efficiency of 23.3 per cent., if realised, will be a creditable achievement.

Another factor which bears on the anticipated efficiency is that the unit system of pulverised-fuel firing has been adopted for the new station, and this is of particular interest in view of the fact that the storage system adopted for the latest boiler installation at the sister station, Nechells, has proved a conspicuous success. No doubt the fact that Hams Hall is likely to be a base-load station under the national scheme is largely responsible for the decision arrived at in this respect, and it is also whispered that the firing system adopted savours somewhat of experiment.

With regard to the question of frequency, we believe that 25 cycles is a temporary measure, and that 50 cycles will be adopted for future extensions. However, the Birmingham district might, we suggest, be considered apart from the general problem; it is a large self-contained industrial area at present served adequately at 25 cycles, and the cost of change-over must be enormous.

Capital cost is always a controversial point, particularly with regard to any new generating station, and Hams Hall can be no exception. While the completed station (210,000 kW) is likely to represent a capital expenditure of something like £15 per kW of main plant installed, for some time the station must represent a much higher figure. The capital cost of the present section is believed to be about £1,400,000, or over £23 per kW. Again, consideration of the station as one for base-load supply has, no doubt, influenced the "powers that be" in the policy of "high efficiency at high capital cost."

We await the results of the working of Hams Hall with more than usual interest.

Rationalisation.

Practically all industrial experts and economists appear to be agreed that there is only one way in which a modern industry can survive the intense competition which is a feature of the world to-day: that is, by the pursuit of "rationalisation." Originally rationalisation meant the apportioning of work among the various units of an industry to meet the demand exactly, *i.e.*, to guard against over-production, as well as to reduce production costs and prices. It now means a great deal more than this.

In a recent lecture (which is reviewed in this issue) Mr. A. P. Young, of the British Thomson-Houston Co., Ltd., made an interesting survey of the course of industry during the last 600 years or so to show how modern industrial conditions evolved, and he went on to enunciate the principles governing rationalisation. His aim was to show the international character of the subject and to relate it to the cause of world peace and brotherhood. Other points were the broadening of the basis of the ownership of industry and the inevitability of reduced hours of labour if rationalisation was not to be a waste of mental and physical effort. Mr. Young acknowledged the difficulty of rationalising such an industry as the electrical industry, which turns out so many articles of widely-differing kinds, and seemed to rely upon simplification and standardisation, aided by continued research, to bring about a rational state of affairs. In our "Business Notes" we review an address on "The Dangers of Rationalisation," by Sir Mark Webster Jenkins, of Vickers-Armstrongs, Ltd. The title is a little misleading. Not rationalisation itself, but its misapplication, or a misconception of what it means, appear to harbour the dangers to which the title refers. Amalgamation is not rationalisation, but may sometimes be expected to produce the same results. In point of fact, it is merely a necessary prelude to rationalisation, which is defined as reconstruction to secure greater efficiency, reduced costs, and expansion in competitive markets. Attention was also directed to the need for competent management and a greater recognition of ability to ensure that there will not eventually be a shortage of capable leaders. Both addresses contained much interesting matter and will repay study by those who are interested in this absorbing subject.

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Potential Connections for Automatic Voltage Regulators.

An Explanation of the "Positive Sequence" Network.

By G. W. STUBBINGS, B.Sc., A.M.I.E.E.

An automatic voltage regulator for an alternating-current generator is used for two distinct purposes. The first of them is to maintain a constant bus-bar voltage with the normal load variations, without the necessity of hand regulation. The second function of the regulator is of even greater importance than the first, and this is automatically to increase the excitation of the generator when a short circuit or heavy load occurs on the system which it supplies, to avoid a condition of instability. For the maintenance of a constant bus-bar voltage with normal load variations, the manner in which the voltage circuit of the regulator is supplied is not a matter requiring much consideration. The load of most systems generating three-phase currents is usually nearly balanced, and the voltages between the three pairs of lines are, in all normal conditions, very approximately equal, notwithstanding the variation of the demand on the generators. It follows therefore that any single-phase supply derived from the main voltage system will, in all conditions of normal loading, be a legitimate measure of the magnitude of the three-phase voltage. It is usual to supply the voltage circuits of automatic regulators from the secondary of a transformer connected between two of the phases, and, as the voltage system is normally balanced, it is a matter of indifference from which pair of phases the voltage circuit is supplied, except in so far as this connection is fixed by a compounding arrangement in which the voltage circuit current is superimposed on the secondary current of a current transformer.

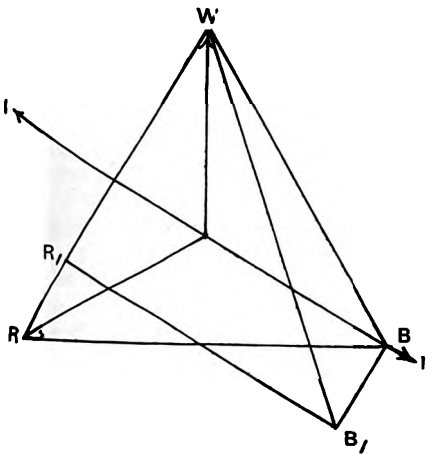

Fig. 1.

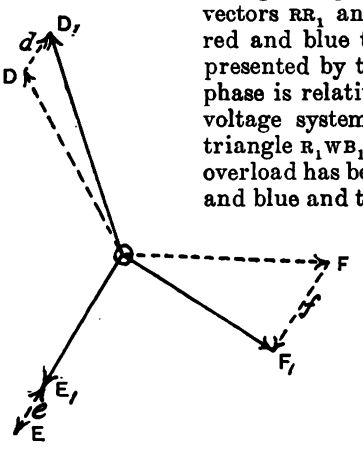

Fig. 2.

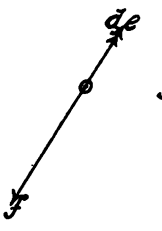

Fig. 3.

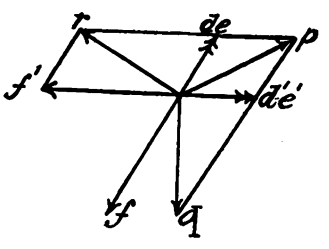

Fig. 4.

When the second function of an automatic voltage regulator is considered, that of maintaining stability of the system under short-circuit conditions, the manner in which the voltage circuit of the regulator is supplied is a matter of considerable importance. A symmetrical short circuit on a three-phase system would be abnormal rather than usual, and the majority of system faults will give rise to single-phase short circuits or overloads. In these circumstances the voltage system will become considerably unbalanced, and for given conditions the diminution in the current in the voltage circuit of the regulator will depend upon the pair of phases system from which it is supplied. The action of the regulator in increasing the excitation current of the generator with which it is associated will therefore depend on a condition additional to the severity of the overload or short circuit.

To illustrate this point in detail, let us consider the effect on the terminal voltage of a star-connected alternator, of a single-phase overload of unity power factor. In fig. 1, the triangle RWB represents the vectors of the line voltages of the alternator on open circuit or when delivering a balanced load. If I is the vector of the single-phase overload current, this current will flow in the red and blue phases of the alternator only, and will give rise to voltage drops, in those phases, which are vectorally nearly in quadrature with the current. These voltage drops are represented in the diagram by the vectors RR_1 and BB_1. The terminal voltage between the red and blue terminals of the alternator becomes as represented by the vector $R_1 B_1$. The voltage in the white phase is relatively unaffected. The three-phase terminal voltage system of the alternator is thus given by the triangle R_1WB_1. We see that the effect of the single-phase overload has been to diminish the voltages between the red and blue and the red and white terminals, but to increase the voltage between the white and blue terminals. An automatic voltage regulator connected between either of the former pairs of terminals would, on the incidence of the single-phase overload, operate correctly and increase the excitation of the alternator with which it was associated. If, however, the regulator were supplied from the blue and white phases, the effect of the overload would be to increase the current in the voltage circuit of the regulator, and to bring about a reduction of the excitation current of the alternator.

It appears from the above argument that, although the usual method of connecting the voltage circuit of an automatic regulator may be quite satisfactory so far as the ability of the regulator to deal with normal load regulations is concerned, this method is quite unsuitable if the regulator is to increase the system stability with certainty when a single-phase overload or short circuit occurs. What is required, if the latter function is to be reliably performed, is some scheme of connections whereby the current in the voltage circuit of the regulator is decreased by an amount depending only upon the severity of the single-phase overload, and irrespective of the phases between which this overload occurs. A scheme of connections which fulfils this condition is being used to an increasing extent in America, where the conditions leading to the instability of large systems has been the subject of considerable investigations. Although the actual

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connections are very simple, it is not easy to see that they fulfil the required conditions. We shall therefore analyse the terminal voltage conditions of an unsymmetrically loaded alternator in some detail, and show how, by a particular method of combining pairs of line voltages, a symmetrical system is obtained from the unbalanced system, which symmetrical system is always reduced in magnitude when a single-phase load is imposed on the alternator.

In fig. 2 we have drawn the three line voltages of the alternator as vectors radiating from a point O; D, E, and F are the line voltages when the alternator is on open circuit, and D_1, E_1, and F_1 are the vectors of the line voltages when the alternator is delivering a single-phase load. The vector differences between the line voltages corresponding to the open-circuit and the load conditions

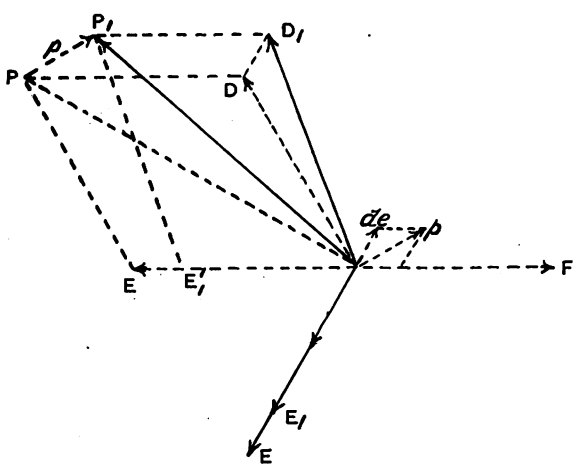

Fig. 5.

are denoted by *d*, *e*, and *f*, and it is seen that these three voltages are co-linear and correspond to the reactive drop due to the single-phase load. We can therefore regard the unsymmetrical system of vectors D_1, E_1, and F_1 as being derived from the symmetrical system D, E, and F, by superimposing upon the latter system a single-phase voltage which has been decomposed into the three vectors *d*, *e*, and *f*. Any method of combining pairs of the symmetrical voltages D, E, and F will evidently lead to another symmetrical system, provided the same method is used for each pair. If, therefore, we can obtain a method of combining the three components *d*, *e*, and *f* of the single-phase voltage, which will convert these components into a symmetrical three-phase system, that method, when applied to the unbalanced system D_1, E_1, and F_1, will also give a symmetrical resultant.

In fig. 3 we have drawn the vectors *d*, *e*, and *f* of the single-phase component of the unbalanced system D_1, E_1, and F_1 radiating from a point O. It is found that, if with each pair of these three vectors we retard the phase of the leading vector by 60 degrees and combine the retarded vector with the lagging vector of the pair, we obtain a symmetrical three-phase system. We have, in fig. 4, carried out this construction for the system of vectors in fig. 3. Selecting the pair of vectors *f* and *d*, f^1 is the *f* vector retarded 60 degrees in phase and *r* is the resultant of f^1 and *d*. Similarly d^1 is the vector *d* retarded 60 degrees in phase, and *d* combined with *e* gives a resultant *p*, whlie e^1 gives with *f* a resultant *q*. Since the magnitudes of *d* and *e* are each equal to one half that of *f*, it is easy to see from the geometry of the diagram that the resultant vectors *p*, *q*, and *r* are all equal in length and are spaced 120 degrees apart.

As the method of combination described will convert a single-phase system of vectors into a symmetrical three-phase system, it follows that this method applied to an unsymmetrical three-phase system will also convert it into a symmetrical system, since the unsymmetrical system is itself made up of a symmetrical and a single-phase component. In fig. 5 we have carried out the construction described for the pair of vectors D_1 and E_1 of the system D_1, E_1, and F_1 shown in fig. 2. Retarding the phase of E_1 by 60 degrees gives E_1^1, which, combined with D_1, gives a resultant P_1. In this diagram D, E, and F are the vectors of a symmetrical system corresponding to the open-circuit conditions of the alternator. Applying the construction described to the vectors D and E of this system gives a resultant P, and it is easy to see that, if with this resultant P we combine the vector *p* derived from the two single-phase components of D_1 and E_1 we obtain the same resultant P_1 as was obtained by combining the vectors D_1 and E_1 according to the rule we have described. It is easy to comprehend, after an examination of fig. 5, that the magnitude of the resultant P_1 will always be less than P for any conditions of single-phase loading of the generator; and it also appears from the reasoning set out above that the magnitude of P_1 will be the same for the same value of the single-phase current from whichever pair of phases this current is supplied.

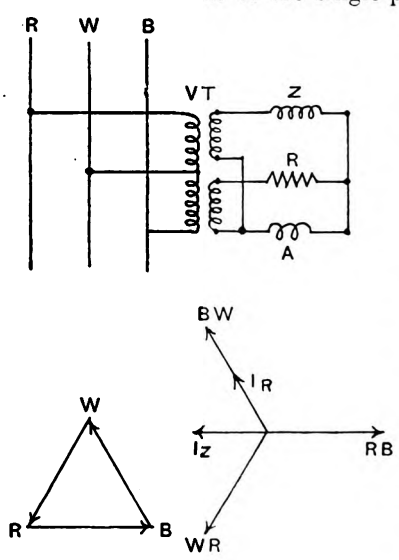

Fig. 6.

The connections of the voltage circuit of a regulator in which this system is adopted is shown in fig. 6. Here R is a non-inductive resistance, and Z is an impedance having an ohmic value equal to that of R, but in which the current lags the voltage by exactly 60 degrees. The resistance and impedance are connected in the secondary system of a system of two single-phase voltage transformers in the manner shown, the voltage circuit A of the voltage regulator being in the common return as indicated. Assuming for the moment that the impedance of A is very small, as compared with R and Z, then the current in R will be in phase with the voltage WB, whilst the current in Z will lag the voltage WR by 60 degrees. Since the voltage WR leads WB, the resultant current in A would be proportional to the resultant P_1 of fig. 5. If, as is the case in practice, the impedance of A is comparable with R and Z, it can be shown that the current in A is still proportional to the resultant P_1 in fig. 5, but differs from it in phase.

The resultant P_1 in fig. 5 is proportional to what is usually known as the positive sequence component of the system, WR_1B_1 of fig. 1. This description is based on the principle that any unbalanced three-phase system can be resolved into two symmetrical or balanced components, the one of normal or positive phase sequence in which the voltage between the blue line and neutral leads the voltage between the red line and neutral, the other being of negative phase sequence in which the red line-to-neutral is the leading voltage. It can be shown that P_1 in fig. 5 is $\sqrt{3}$ times one of the positive sequence star voltage in magnitude, and leads it by 30 degrees in phase. The system of connections in fig. 6 is generally known as a 'positive sequence' network.

An "All-Electric Home" at Edinburgh.

An "All-Electric Home" at 22, Eglinton Crescent, Edinburgh, was formally opened on October 23rd by Lord Sands. The exhibition, which has been arranged by the Edinburgh Electrical Development Committee, representing the Corporation Electricity Department, the Edinburgh Branch of the Electrical Contractors' Association of Scotland, and the local wholesalers and manufacturers, remained open till November 6th. Lord Sands said there were three houses similarly equipped in the city, and such was the interest taken in the matter that they had been visited by 41,000 persons.

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The Hams Hall Station.

The initial section of the new electricity generating works of the City of Birmingham Corporation has a plant capacity of 60,000 kW, is equipped for pulverised-fuel firing on the unit system, and is expected to have an overall theoretical efficiency of 23·3 per cent.

THE new generating station at Hams Hall of the City of Birmingham Corporation, which was to be officially inaugurated on Wednesday this week by the Duke and Duchess of York, stands out as an excellent example of modern power station engineering. Visitors to the station in search of novelty, apart from considerations bearing on the size of the plant, will be disappointed, as generally the installation is representative of well tried equipment, and may be described as a good straightforward job.

A feature of particular interest is that pulverised-fuel firing on the unit system is employed. From the anticipated efficiency figures given later in the article for the boiler and turbine plant, respectively, the complete station is expected to have an overall maximum theoretical efficiency of 23.3 per cent.

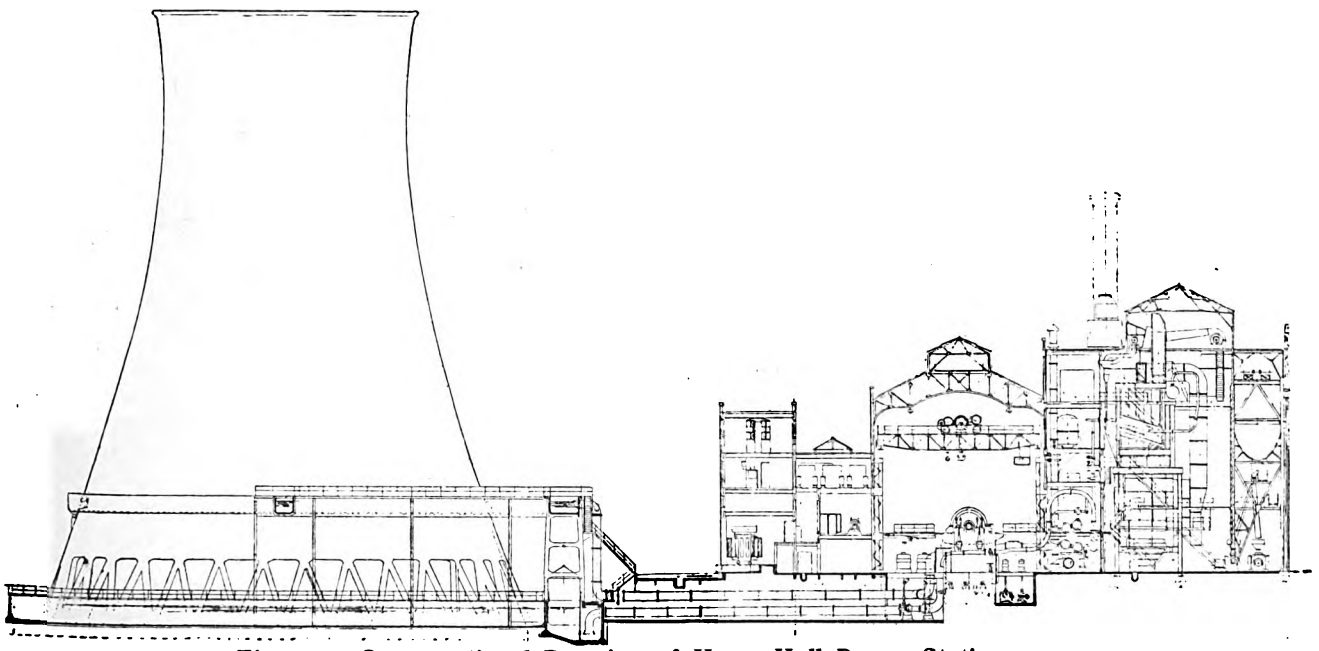

Fig. 1a.—Cross-sectional Drawing of Hams Hall Power Station.

The station, fig. 2, is built on reinforced-concrete stools, without piles, and the main turbo-alternator foundations are isolated from the building column bases to prevent vibration from the main turbines being transmitted to the superstructure, which is a braced and framed steel building, designed to be self-supporting, with brick filling. The total volumetric capacity of the power station proper is 4,000,000 cu. ft., or 42.7 cu. ft. per kW to be installed in the present section, *i.e.*, 93,750 kW.

Water for boiler make-up purposes is obtained from the 36-in. main from the Whitacre reservoir of the Corporation Water Department, and a pipeline connects this to a lime and soda water-softening plant. After being treated by this plant the water is discharged into a reservoir, fig. 1c, having a capacity of 5,850,000 gal., and from this reservoir the water is pumped through "Permutit" water-softening plant and passed on to the feed tanks in the boiler house. The normal capacity of each of the softening equipments is 12,000 gal. per hour.

The main railway sidings which serve the station are adjacent to Coleshill station on the L.M. & S. Railway, and have been arranged somewhat in the shape of a semi-circle, with the sidings for empty trucks on the one side and full trucks on the other; each set of sidings can accommodate 220 standard 20-ton railway trucks. A railway weighbridge is installed on one line with a by-pass siding. Coal trucks can be fed by gravity on to the tipplers at up to 100 tons of fuel per hour. Each tippler empties the fuel from the trucks into a screened hopper arranged below, and registers the weight of fuel discharged from the trucks. The coal is then elevated by means of bucket conveyors, one for each tippler, on to inclined-belt conveyors in duplicate, each bucket conveyor and each inclined belt being capable of handling 100 tons of fuel per hour. The coal from the inclined-belt conveyor is discharged into a hopper from which two shuttle belt conveyors are fed, and which are arranged to distribute the coal to any of the bunkers in the boiler house. For stocking out there is a store belt conveyor consisting of a separate horizontal belt having an average capacity of 100 tons of coal per hour from truck to store. The coal is fed from this belt to a motor-driven travelling belt distributor, which discharges on to the ground on either side of the main belt. From here it is handled into the stocking ground by a steam-driven jib crane. The steam crane, which has a working radius of 60 ft., is also used for reclaiming the fuel. The reclaimed fuel is deposited into a travelling hopper discharging on to the main belt, the latter being reversed in direction, discharging the reclaimed fuel to the inclined-belt conveyors, and thence to the coal bunkers in the boiler house (see fig. 3).

A water-sluice system is installed for dealing with the ashes and dust from the boiler plant. The water is flushed down sealed channels, carrying the ash to a settling sump having a storage capacity of 360 tons of dry ash mixed with water. The ashes are handled from the sump to special standard-gauge trucks by means of a telpher.

The present boiler plant consists of five units, each having a normal evaporative capacity of 190,000 lb. per hour from water at 295 deg. F., and a maximum capacity of 228,000 lb. per hour under the same conditions. The

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steam-range pressure is 375 lb. per sq. in., with a total steam temperature of 710 deg. F. The safety blow-off pressure on each boiler drum is 405 lb. per sq. in. The boilers are of the Babcock & Wilcox water-tube type, each having an external heating surface of 20,000 sq. ft.; the external heating surface of the two superheaters fitted per boiler is approximately 4,566 sq. ft. A "Usco" air heater, fig. 9, is fitted to each boiler unit, and this has a heating surface of 40,800 sq. ft. The temperature of the air leaving the heater under normal rating conditions is 370 deg. F., with 16 per cent. CO_2 in the flue gases, when the temperature of the latter is 275 deg. F.

The boilers are fired with pulverised fuel, and the volumetric capacity of each combustion chamber is about 14,000 cu. ft. Each side and back wall is protected by "Murray" tubes having a heating surface of 1,822 sq. ft.; at the bottom of the combustion chamber is a water screen with a heating surface of about 360 sq. ft. In the front wall, fig. 5, which is not water cooled, five p.f. "Lopulco" turbulent type R burners are fitted, each having a normal duty of 54,200,000 B.th.u.'s per hour. Each burner consists of a chamber into which the pulverised fuel mixed with air is fed, and the further quantity of preheated air necessary for complete combustion is admitted through adjustable vanes; the air and fuel are thus intimately mixed and projected into the combustion chamber in helical turbulence. The boilers are equipped with "Lopulco" water-cooled combustion chambers, the design of which has been developed to meet the conditions brought about by pulverised-fuel firing. The refractory materials generally used for furnace construction have been replaced in the case of the rear and side walls by "Usco" Murray fin tubes, which form a complete water-cooled metal screen. The tubes pass out at the top and bottom into headers connected with the water space of the boilers, and in consequence a continuous circulation of water takes place through the walls with the generation of considerable quantities of steam due to the absorption of radiant heat from the intense flame produced by the burners. The latter are located in the front wall, which is of normal brick construction. The ash hoppers are separated from the combustion chambers by a series of water-cooled tubes connected up to the boiler, which serve to cool the molten-ash particles below fusing point before settling in the ash hopper, thus preventing slagging. The walls add over 1,800 sq. ft. of effective radiant heating surface, and the water screens about 360 sq. ft. to the heating surface of each boiler.

Pulverisation is effected on the unit system, and five unit pulverisers, figs. 4 and 17, of the "Atritor" type (ELECTRICAL REVIEW, June 7th, 1929, p. 1002) are provided for each boiler unit, each capable of dealing with 4 tons of coal per hour. The coal is ground to an extent that 63 per cent. will pass through a 200 standard mining and metallurgy mesh sieve. Four of the mills on each boiler unit are driven by a.c. motors, 120 h.p., 1,440 r.p.m., and one, for ease when starting up, by a d.c. motor, 144 h.p., 1,440 r.p.m. Three boiler feed pumps are provided, two electrically driven and one stand-by steam turbo-driven pump; each pump is designed to deal with 50,000 gallons of feed water per hour, and to deliver this against a pressure of 480 lb. per sq. inch to the main feed-water ranges supplying the boilers.

The overall efficiency of the boiler-house plant, when using coal as received with 20 per cent. total moisture and having a gross calorific value of 8,000 B.th.u.'s per lb., is expected to be 81.75 per cent. when the boilers are working at their normal rating; this figure includes all power absorbed by coal- and ash-handling, pulverisers, and draught plant.

The main generating plant so far installed consists of two 30,000-kW turbo-alternator sets, 1,500 r.p.m., 25 cycles, 11,000 V, figs. 6 and 10. The turbines are of the single-casing type fitted with impulse blading throughout. The steam first expands in a velocity stage with two rows of moving blades, which are followed by three drums, of small to medium diameters, carrying a total of 30 rows of blading, and the final expansion takes place in six single impulse stages of large diameter. In the high-pressure end the blading is made of nickel-steel as far as the ninth stage of the first drum; beyond this point the blading consists of stainless-steel in the case of the machined blades and rustless-iron in that of the stationary low-pressure blading.

The front end of the turbine casing is made of cast-steel, and the exhaust end of cast-iron. The joint between the two parts lies in the region of pressure below atmosphere, and, in consequence, is subject to only moderate temperatures. The high-pressure end of the casting forms the live steam belt, which is closed at the horizontal joint, the steam being admitted to the top half through external pipes. The casing is provided with three bleeder branches for feed-heating purposes. These are arranged after each of the three drums. As the leaving energy of a stage preceding a bleeder branch is practically lost, advantage has been taken of a larger blading diameter in the next following drum in order to obtain the most favourable relation of blade length and mean diameter. The oil for the relay service and lubrication is obtained from two main oil pumps driven through worm gearing from the main shaft. A stand-by oil pump of the turbine type is provided, and is motor driven and automatically controlled. It is mounted on the oil tank, which has a capacity of 1,300 gal. The oil coolers, which are of the "Serck" type, are in duplicate and provided with interlocked change-over valves. The steam conditions at the turbine stop valve are 350 lb. per sq. in. and 700 deg. F.

Each main condenser, fig. 20, is of the surface type, having a cooling surface of 45,000 sq. ft. The quantity of circulating water at 75 deg. F. required at the maximum rating is 26,500 g.p.m. to maintain a vacuum of 28.12 in. of mercury at the turbine exhaust flange, with the barometer at 30 in. of mercury. The water friction drop across the condensers, tubes, and water boxes is estimated at 6.5 ft. head at the above water flow. Two d.c. motor-driven circulating pumps, fig. 14, are installed for each condenser, one being driven by a supply from a generator coupled direct to the main alternator shaft, and the other by a separate house-service supply. Two full-duty d.c. motor-driven extraction pumps are included, and an

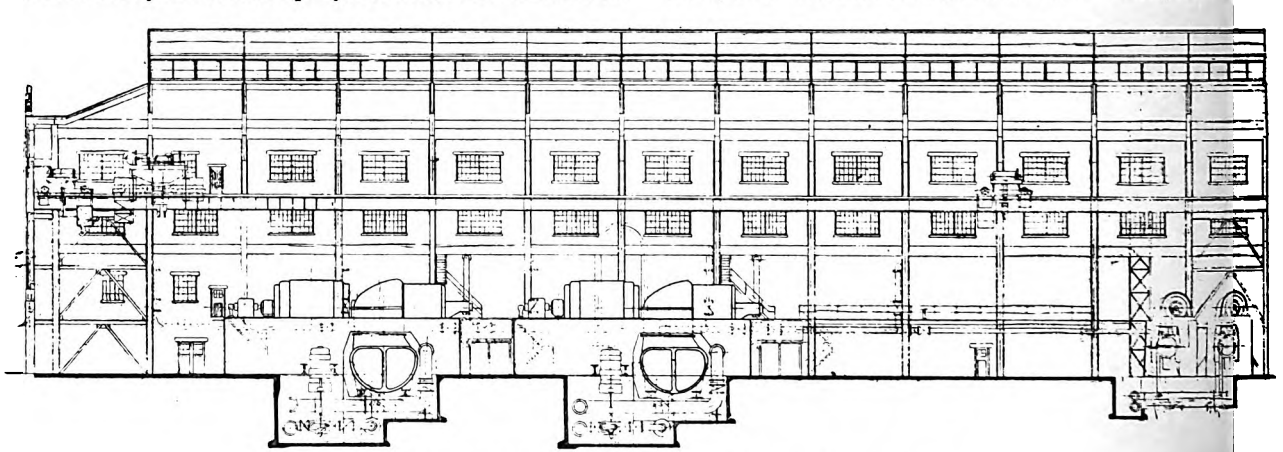

Fig. 1b.—Sectional Elevation of the Turbine Room.

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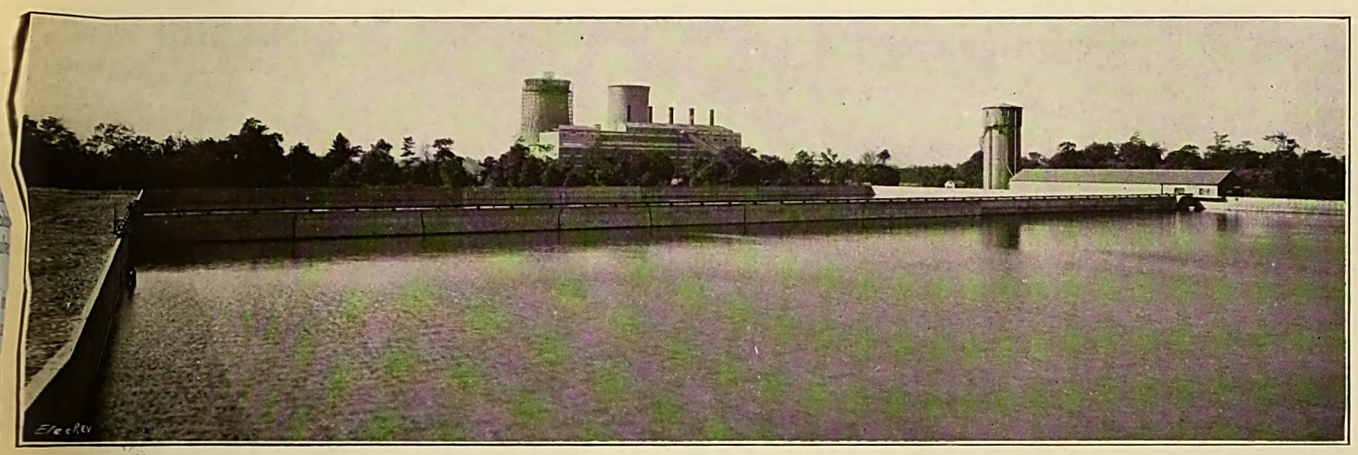

Fig. 1c.—Looking at Hams Hall Power Station across Reservoir.

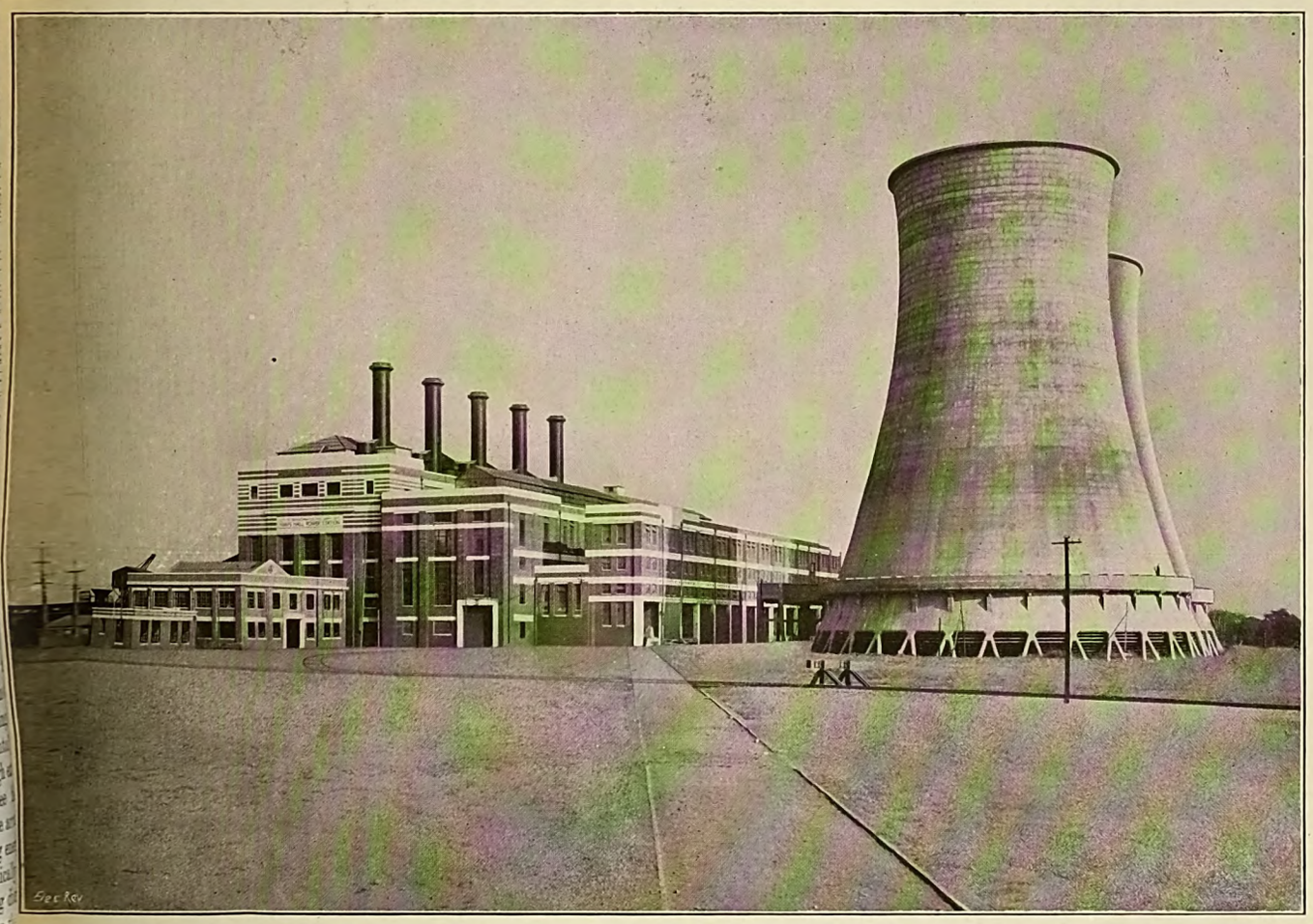

Fig. 2.—General View of the Station, showing the Cooling Towers.

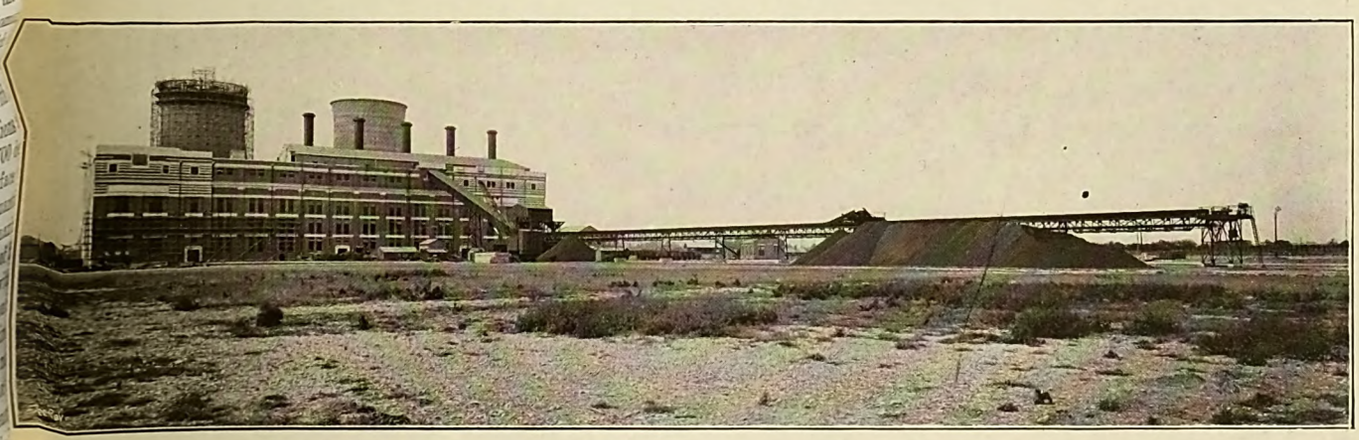

Fig. 3.—Another View of the Works, depicting the Coal-handling Plant.

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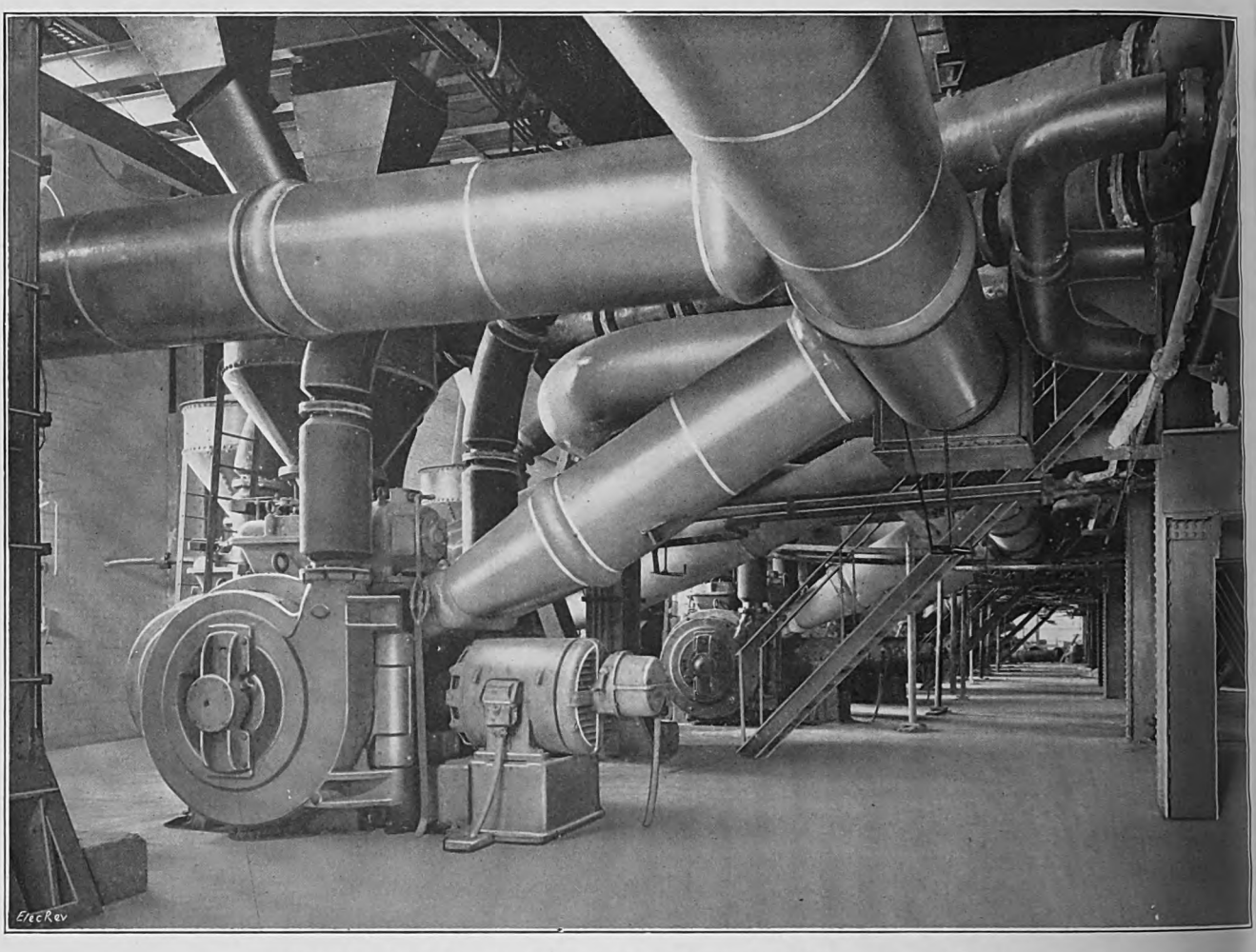

Fig. 4.—"Atritor" Pulverising Mills in Boiler-house Basement.

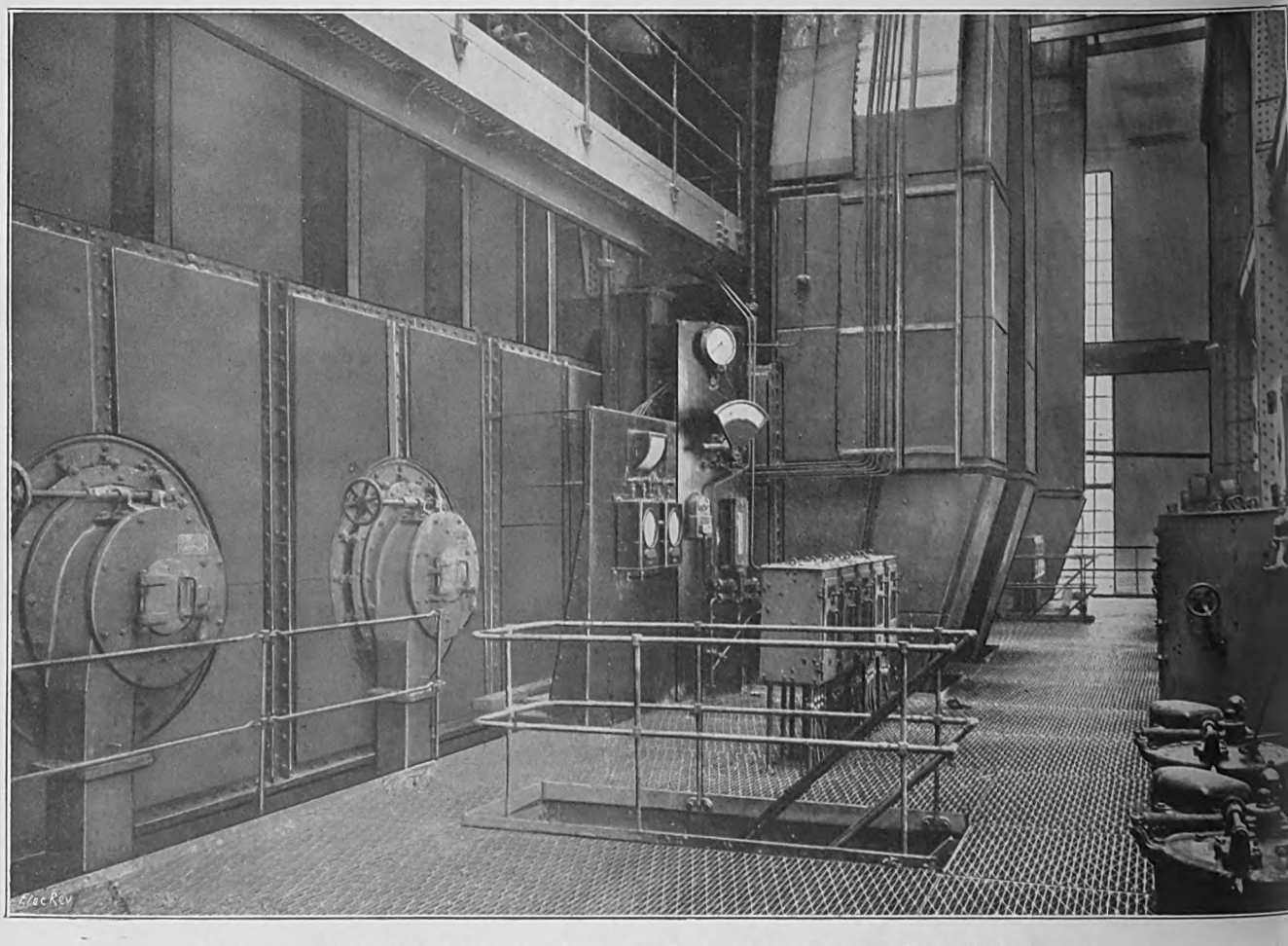

Fig. 5.—The Front of one of the Boilers, showing two of the P.F. Burners.

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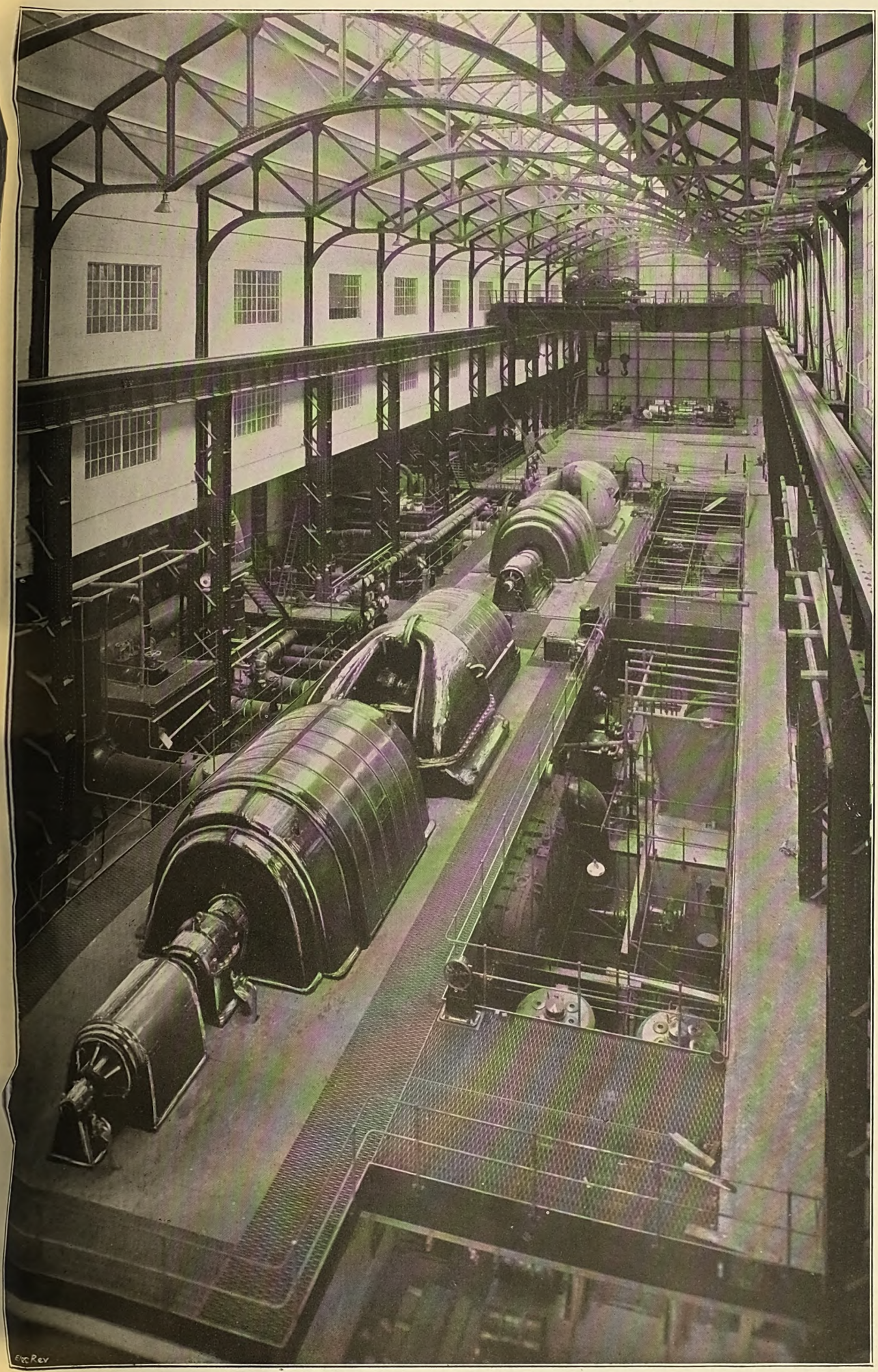

Fig. 6.—General View of the Turbine Room; House Sets in Background.

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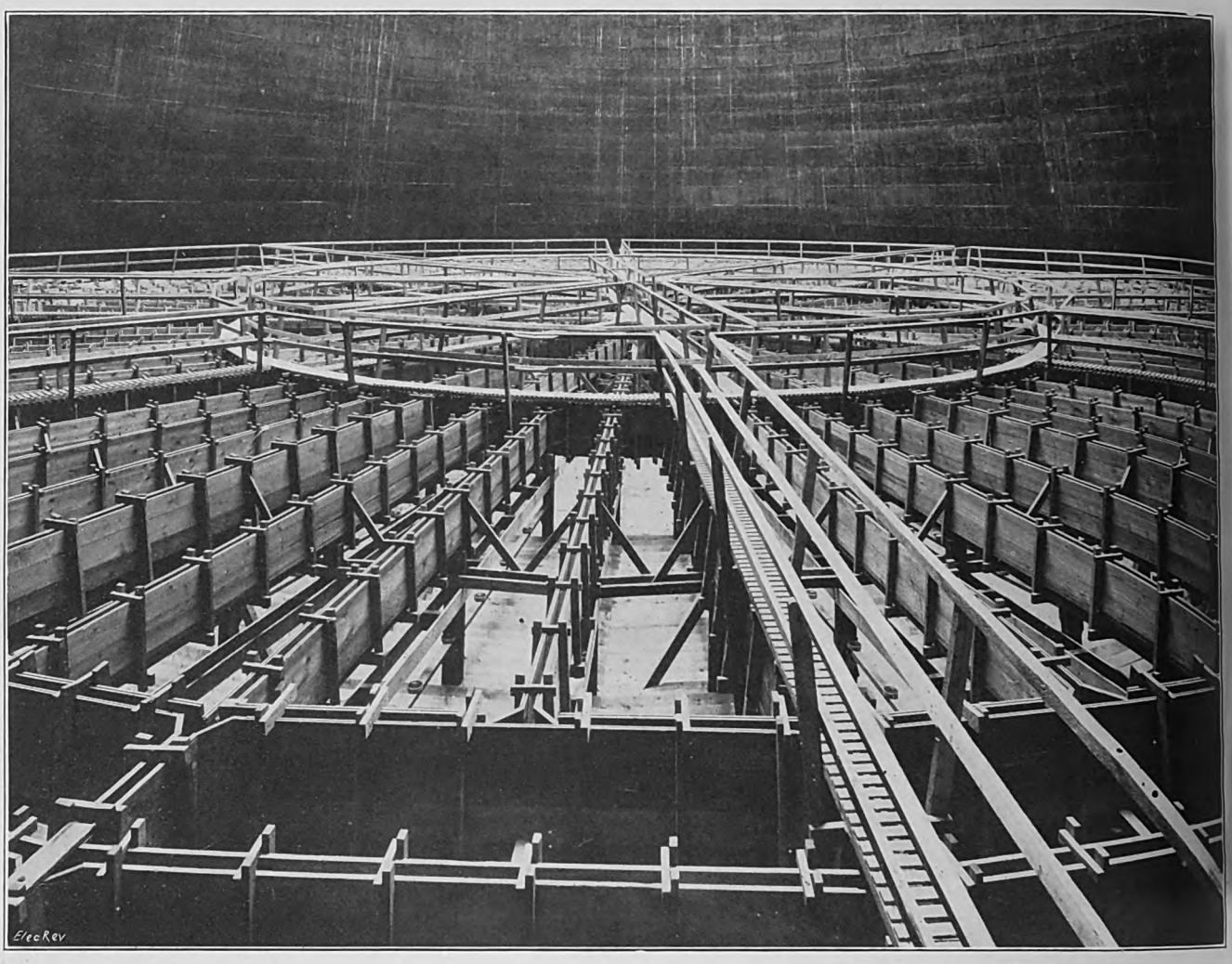

Fig. 7.—Looking Inside one of the Cooling Towers.

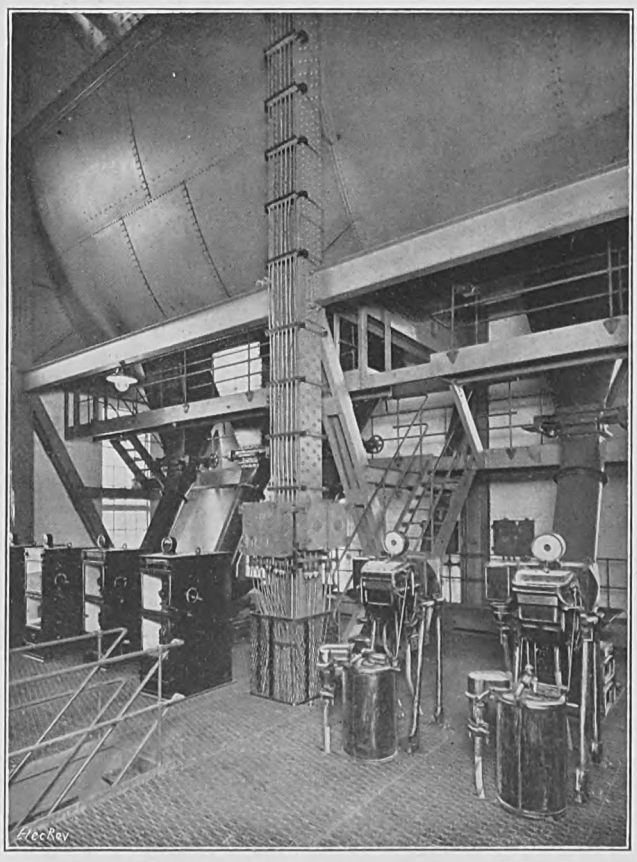

Fig. 8.—Mill and Fan Control Floor.

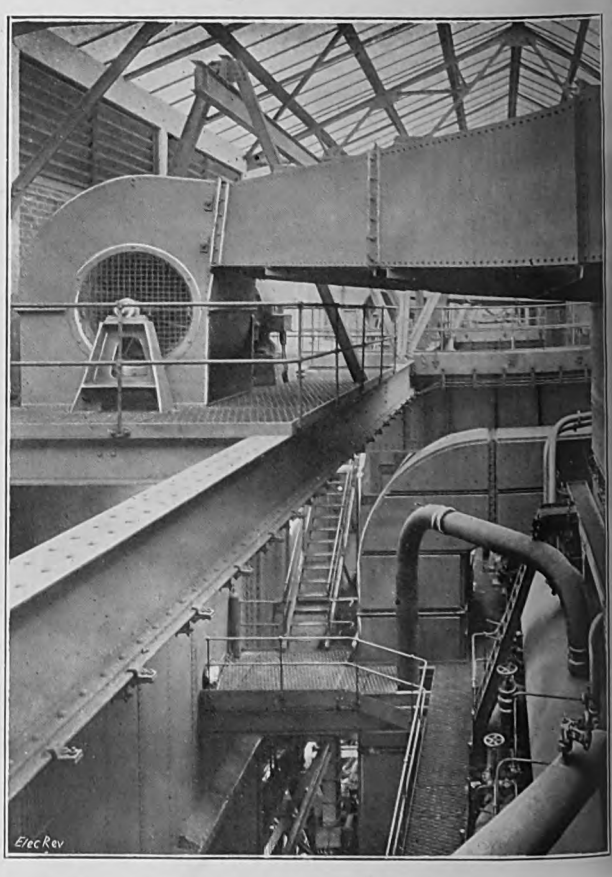

Fig. 9.—F.D. Fan; Air Heater on Right.

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Fig. 12.—The Control Room; A.C. Board on Left, D.C. Board on Right.

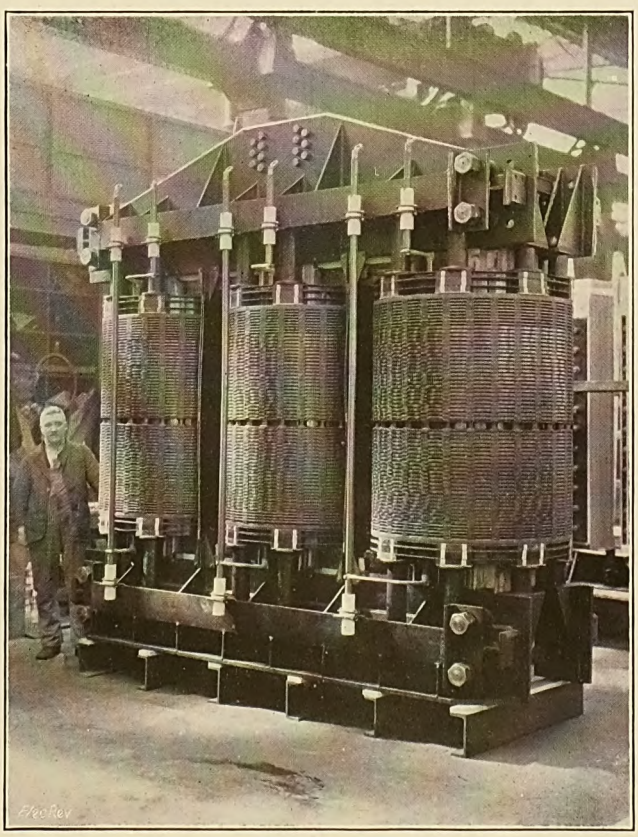

Fig. 13.—One of the Step-up Feeder Transformers.

Fig. 14.—Circulating-pump Motors; D.C., 400

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Fig. 15.—General View in the D.C. Switchgear Room.

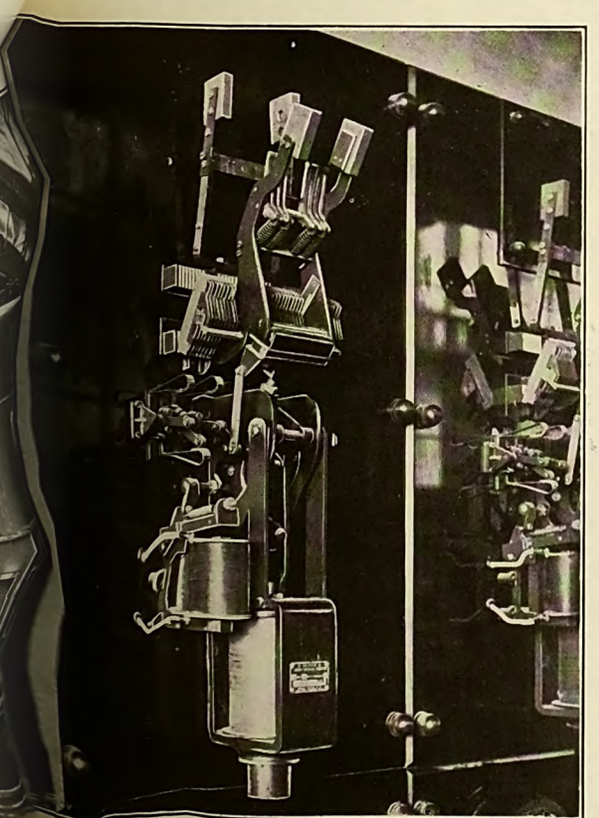

Fig. 16.—Line Contact Circuit Breaker; 4,000 A, 480 V, D.C.

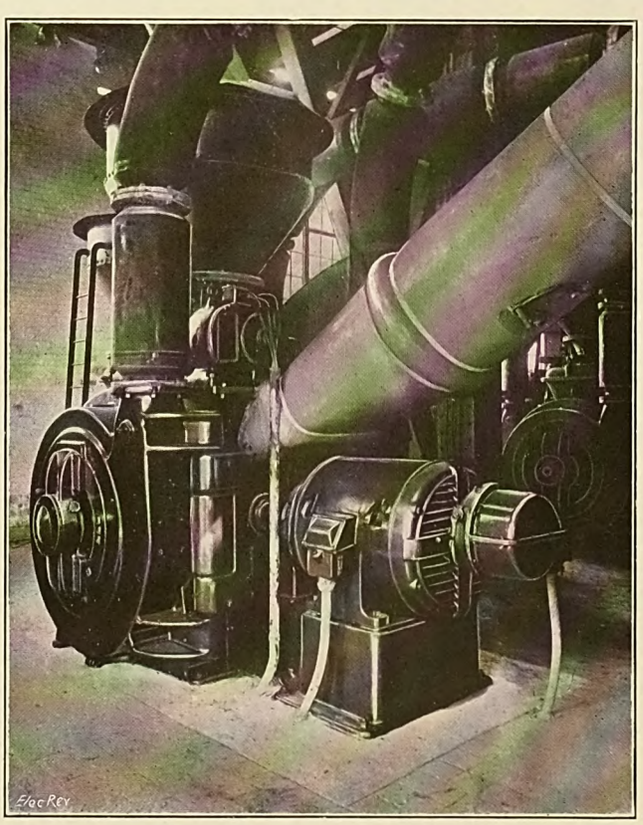

Fig. 17.—Slip-ring Motor (120 h.p.) Driving Pulveriser.

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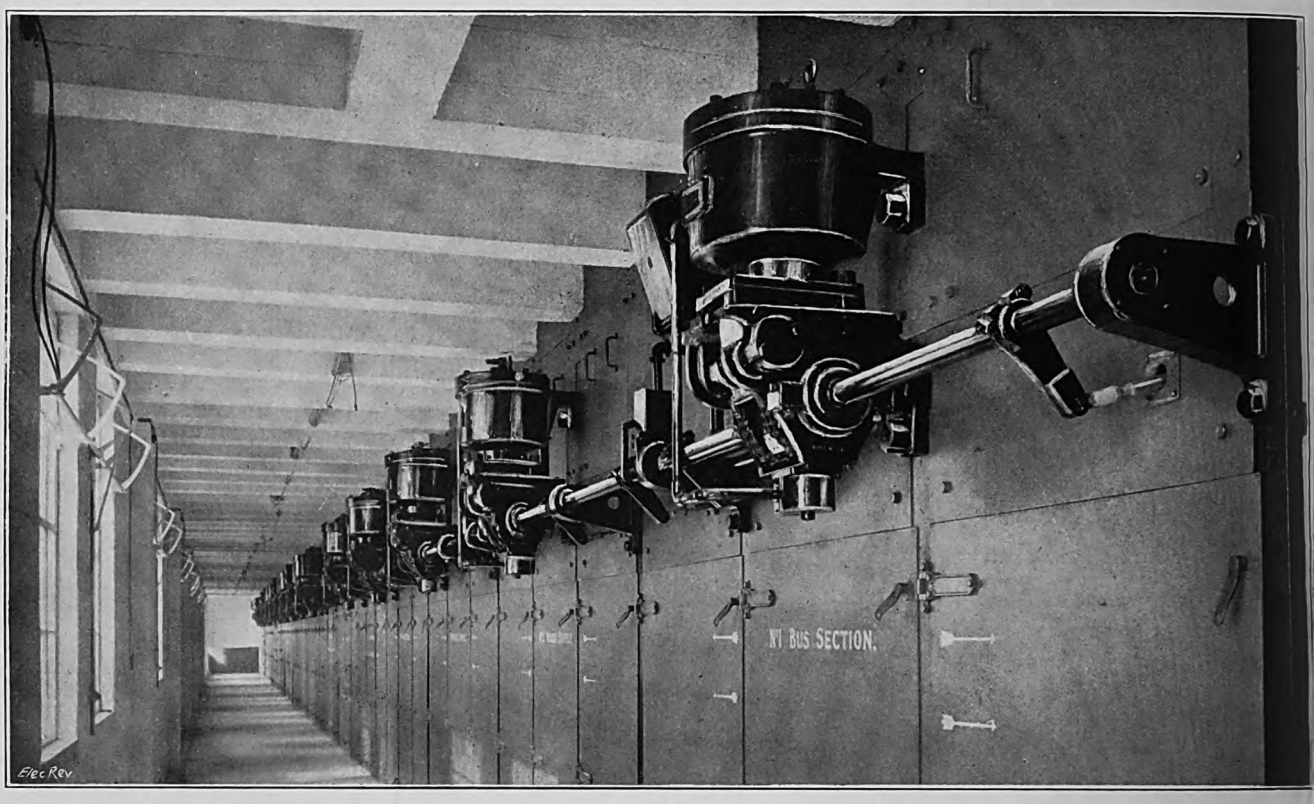

Fig. 18.—High-pressure Stonework Cubicle Switchboard; 11,000 V.

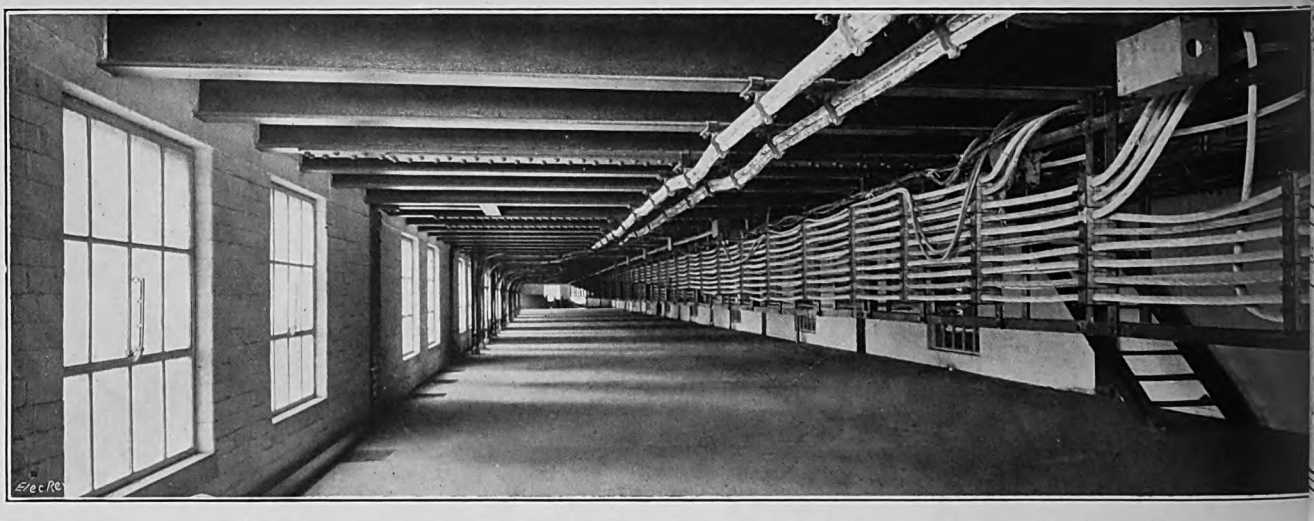

Fig. 19.—View in Switch House, showing Cables Partly Installed.

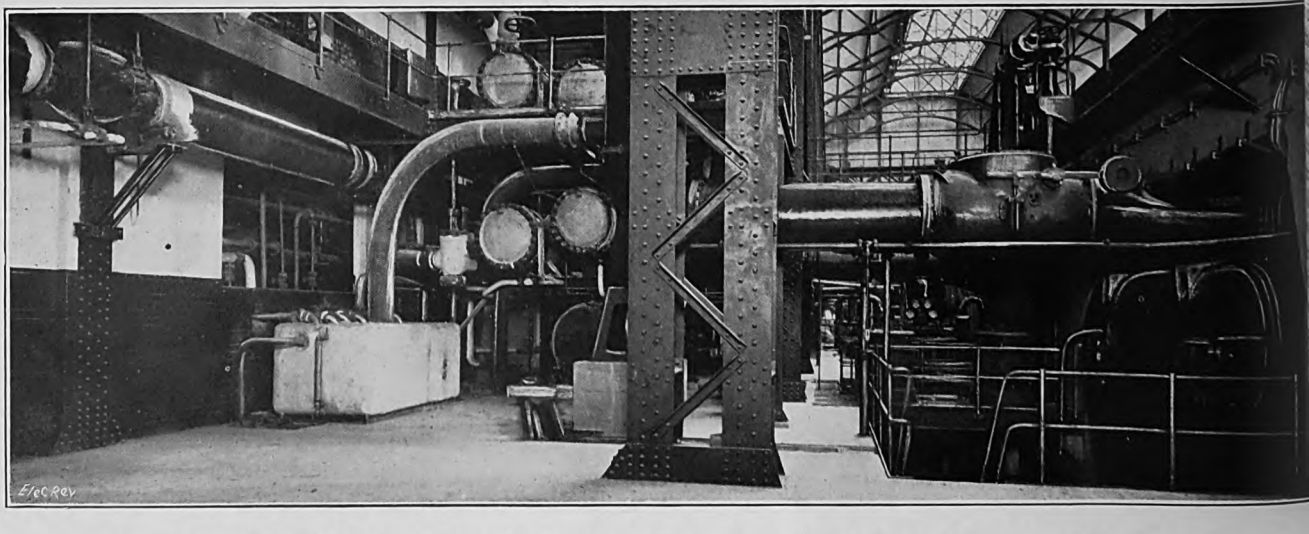

Fig. 20.—Condenser Basement; Bled-steam Boiler Feed Heaters on Left.

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alternative supply for these is arranged as in the case of the circulating pumps. The extraction pumps withdraw the condensate and make-up water from the condenser and discharge it, together with the drain water, through the drain and low-pressure heater to the reserve feed tanks in the boiler house. The whole of the condensate and make-up water then passes through deaerators arranged on the suction side of the feed pumps, and the feed pumps discharge the feed water through intermediate and high-pressure heaters to the boilers.

The main alternators have a continuous output of 37,500 kVA at 0.8 p.f., 11,000 V, 3-phase, 25 cycles, 1,500 r.p.m. The cooling of the ventilating air (which is on the closed system) is effected by means of twin tubular-type air coolers mounted in each case in the foundation block beneath the alternator. Due to transport difficulties it was necessary to build and wind the alternator stators on site under the main engine-room crane. The reason for this will be better appreciated when it is realised that the completed stator weighs 125 tons, whereas the heaviest single part of the stator to be brought to site weighed only 27 tons. The alternator rotor, built from a solid forging and weighing 45 tons, was brought to the site complete. Driven directly from the end of the alternator rotor are the exciter and the auxiliary generator. These machines are electrically separate, but they are mounted in a common shell. Excitation is at 220 volts, while the auxiliary generator is of sufficient capacity to supply one main circulating-water pump and one main extraction pump with current at 440 volts.

The d.c. house supply is provided by two 1,875-kW turbines running at 3,000 r.p.m. and coupled through gearing to generators running at 500 r.p.m. and generating direct current at 460 volts, fig. 11. The turbines are provided with a separate condensing plant; each unit can be run up independently of the main sets. Two 500-kW motor-generators, 11,000 V a.c. to 460 V d.c., are also provided for house supply.

For the purpose of erection and overhaul three cranes are provided in the engine room, running on the same set of rails on one level. The main crane is capable of handling a load of 135 tons, and the two smaller high-speed cranes are each capable of handling 25-ton loads.

Two cooling towers are provided for the present installation. Each tower is of ferro-concrete construction, having a diameter of 168 ft. at the base and a height of 210 ft. from the pond coping level. The height of the water inlet above the pond coping level is 35 ft. Each tower is capable of cooling continuously 2,666,666 gal. of circulating water per hour, with a temperature difference of 17 deg. F. between the inlet and outlet water temperature, with a wet bulb reading of 52 deg. F. Each tower is built over two separate ponds, and is so arranged that one half of the tower can be closed down while the other half is left working. The guarantees relating to the tower are unaffected by this procedure, and a half tower will cool not less than half the amount of water that can be dealt with by the complete tower. Measuring weirs are provided in each pond to enable the amount of water cooled to be measured. The ponds are isolated from each other and from the suction culvert by means of penstocks. The internal irrigation of the tower, fig. 7, consists of troughs and wood-lath construction. The discharge and distribution troughs are ferro-concrete, and sectionalising gates are so arranged that these troughs can be isolated from the main discharge trough and sectionalised between each half tower. The total amount of water capable of being contained in each complete cooling-tower pond is 1,736,000 gallons.

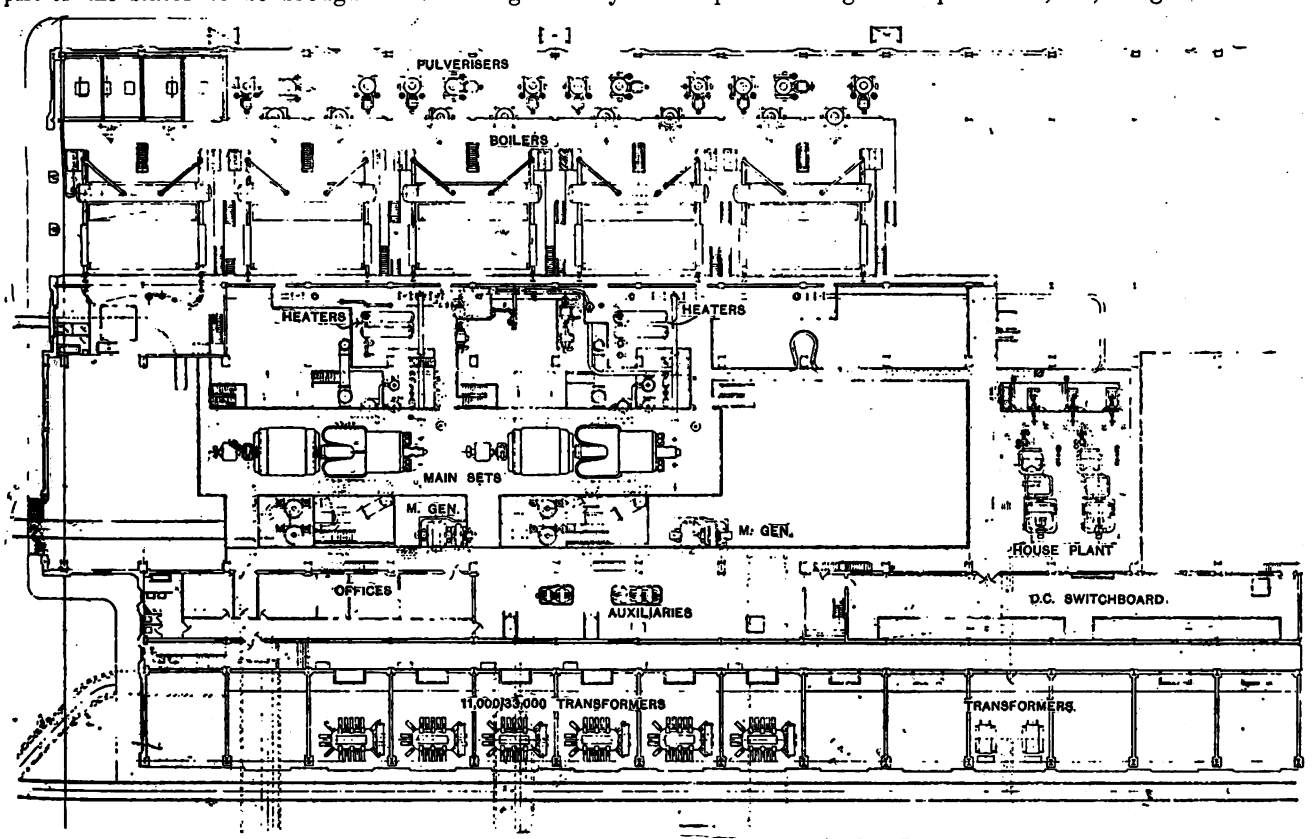

Fig. 21.—Plan, showing the Lay-out of the Plant.

The overall maximum theoretical efficiency of the turbine plant is expected to be 28.59 per cent. at the economical rating of the main turbines, and this figure includes the auxiliary power used by the condensing-plant auxiliaries, and feed and make-up pumps.

The switchgear section of the Hams Hall contract is of a particularly comprehensive nature and includes many features worthy of comment. The equipment includes a large 11,000-volt stonework cubicle switchboard, electrically remote controlled, a d.c. flat-back switchboard, which is also electrically controlled, together with the control boards. In addition, there are several electrically operated auxiliary switchboards, a low-pressure a.c. board of the metal-clad type for controlling the house supply from two 1,750-kVA transformers, and a 33,000-volt isolating-link cubicle board on the e.h.p. side on the main transformers. The whole of this switchgear is contained in a four-storey building adjacent to the main building. On the top two floors are installed the 11,000-volt stonework cubicle board and the control board, the former occupying the greater portion of the two floors, while on the two lower floors, which dovetail to a certain extent with the main building, are situated the d.c. and a.c. boards, auxiliary panels, and the 33,000-volt isolating-link cubicles.

The 11,000-volt cubicle board, fig. 18, is divided into

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21 main panels, control being provided for the two main turbo-alternators, six trunk feeders supplying power direct to various sub-stations, the motor-generator sets and the works supply transformers. There are also several cubicles containing bus-bar couplers, section switches, and similar gear. Main and transfer busbars are provided, each with its own set of isolating links, &c. The equipment of the cubicles, which is practically the same for all the circuits controlled, with the exception that each alternator is supplied with a potential transformer and two oil circuit breakers, one for connecting to the main busbars and the other for the transfer bars, consists of an oil circuit breaker, isolating links and instrument transformers. For all the circuits controlled the breakers have a rupturing capacity of 750,000 kVA.

The control room, fig. 12, is also situated on the top floor and contains the necessary control boards for the remote electrical operation of the switchgear previously enumerated. These control boards extend down both sides of the room, facing each other, that controlling all the a.c. circuits being on one side, while that controlling all d.c. circuits is lined up on the opposite side. The a.c. board controls the alternator cubicles, six trunk feeder cubicles, bus section switch, bus coupler, works supply cubicles, and the two motor-generator cubicles. Each alternator control panel is equipped with two two-way control switches for operating the oil circuit breakers; red and green signal lamps indicate the positions of the breakers. A further control switch operates a single-phase oil circuit breaker installed in the neutral earthing circuit of each alternator. All the alternator, feeder, works supply and motor-generator panels are equipped with the McColl protective system.

The d.c. control board is equipped with panels controlling the two auxiliary generators, the d.c. sides of the two 500-kW motor-generator sets, the battery and booster, trip circuit master control, works lighting and power, and the two house turbo-generators. Engine room telegraphs and telephones are also installed in the control room, and are mounted on pedestals in front of the appropriate panels.

The d.c. switchboard, fig. 15, is on the same floor level as the turbo-alternators, and is housed in one room. The positive and negative boards controlling the same circuit are separated from each other, so that the board is split into positive and negative sections. The panels control the two 1,875-kW house turbo-generators, the two 500-kW motor-generators, the boiler house works supply, the auxiliary generators, condenser auxiliaries, 220-volt lighting circuits and the battery. Thus three sources of supply are available for the d.c. board, namely, the house service generators, the motor-generators, and the battery. Most of these panels are equipped with a new type of d.c. circuit breaker which has recently been developed by the General Electric Co. It is known as the line contact circuit breaker, fig. 16, and gives a greatly improved form of laminated contact. The laminations are in the form of standard vee-edged blades, bedding into corresponding grooves formed in the contact block. By using any number of these blades any capacity of cricuit breaker may be constructed up to 20,000 A with the utmost ease and without overheating. Those on the various d.c. switchboard panels vary between 1,000 A and 4,000 A capacity. By an ingenious feature of design, not only are the contacts self-aligning, but they are also self-cleaning, as during the process of closing a vertical sliding action is transmitted to the blade, so that each surface is effectively cleaned at every operation of the breaker.

In the basement of the switch house are located the main 12,000-kVA feeder transformers which step-up from the generating pressure to 33,000 V, fig. 13. These transformers are of the 3-phase, core type, and are physically the largest entirely self-cooled transformers in this country. The cores are interleaved throughout, this construction being effective in reducing the humming so often with large cores of the noticeable "butt" type. The cores weigh 28 tons complete, with clamps and coil supports, the latter being of especially massive construction, in order to provide adequate protection against the enormous mechanical forces brought into play in the event of a short-circuit. The clamps and core are securely held by Ferranti's square bolt arrangements. The whole transformer is provided with centre point lift, eliminating excessive strain on lifting slings and bolts.

The windings are of the standard concentric arrangement, and consist of disk coils connected in parallel down the leg, amply provided with axial and radial cooling ducts, so that every conductor is in contact with the cooling oil. All spacing pieces are self-locking, preventing their floating out under any conditions. The main insulation consists of oil and solid-paper barriers in series, uneven stressing of material being avoided by careful control of the dielectric field.

Against surges "creepage" insulation is not relied upon, for its time lag being so much lower than that of solid insulation, a larger factor of safety against transient voltages is obtained by its elimination. The losses are dissipated by externally detachable radiators.

The efficiency of the transformers at ¾ load is 99.125 per cent., against a guaranteed value of 99.00 per cent. The weight of each transformer, complete with oil, radiators and all accessories, is 60 tons. The works supply transformers, 11,000/440 V, are also housed in the basement, as are also the 33,000-volt isolating-link cubicles, together with the liquid earthing resistances for earthing the neutral points of the two main turbo sets and the six main feeder transformers. Each of the latter is situated in a separate room, the six rooms running the length of the switch-house. With each transformer is associated one of the 33,000-volt isolating-link cubicle switchboards previously mentioned and the appropriate earthing switch.

A 3-wire battery having a capacity of 1,152 A for one hour is installed in the battery room, adjacent to and on the same floor level as the oil circuit-breaker room. The battery will act as a stand-by to the d.c. generators for the works power and lighting supplies. Master panels are provided to enable the works power and lighting supplies to be taken, either from the main d.c. busbars or from the battery. The d.c. trip circuits for the whole of the switchgear are also arranged for alternative supplies. Lay-out drawings of the station and plant are shown in figs. 1a, 1b and 21.

The main machinery hall is illuminated by "Maxlume" reflectors of a special concentrating type, with a chromium-plated reflecting surface, the boiler house and pulverised-fuel section are lighted by "Maxlume" totally-enclosed gas-tight cast-iron fittings, and the switch room by "Maxlume" enclosed units and angle reflectors.

The contract for the complete station was let to Messrs. International Combustion, Ltd., who sub-let the various sections to the firms mentioned. The station has been designed by Mr. R. A. Chattock, M.I.E.E., city electrical engineer to the Birmingham Corporation.

The following are the contractors and sub-contractors for the more important items of equipment:—Building and civil engineering, coal and ash-handling plant, Mitchell Conveyor & Transporter Co., Ltd.; combustion chamber, &c., International Combustion, Ltd.; boilers and superheaters, Babcock & Wilcox, Ltd.; air heaters, ash-sluice system, &c., Underfeed Stoker Co., Ltd.; draught plant and dust catchers, Davidson & Co., Ltd.; steel chimneys, E. N. Wright, Ltd.; pulverisers, Alfred Herbert, Ltd.; concrete cooling towers, Joshua Henshaw and Sons; overhead electric cranes (engine room), Sir William Arrol & Co., Ltd.; weighing machines, W. T. Avery & Co., Ltd.; instruments, Industrial Combustion, Ltd., Negretti & Zambra, Ltd., and Dewrance & Co., Ltd.; turbo-alternator sets, d.c. generators, rotary convertors, main switchgear, motors, and cables, General Electric Co., Ltd.; condensing plant, Hick, Hargreaves and Co., Ltd.; boiler feed pumps (electric), Mather and Platt, Ltd.; boiler feed pumps (steam), G. & J. Weir, Ltd.; water-softening plant, United Water Softeners, Ltd.; transformers, 11,000/33,000-V, Ferranti, Ltd.; battery, Tudor Accumulator Co., Ltd.; oil coolers, Serck, Ltd.; air coolers, Premier Co., Ltd.; and lighting fittings, Veritys, Ltd.

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French Electric Ploughing Trials.

Comments on the Design and Performance of the Several Types of Machines Demonstrated.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., E.R.Ae.S.

UNDER the auspices of the French Ministries of War and of Agriculture the annual ploughing trials have just been concluded. These demonstrations are considered to be of vital importance in France, because that country takes the attitude that

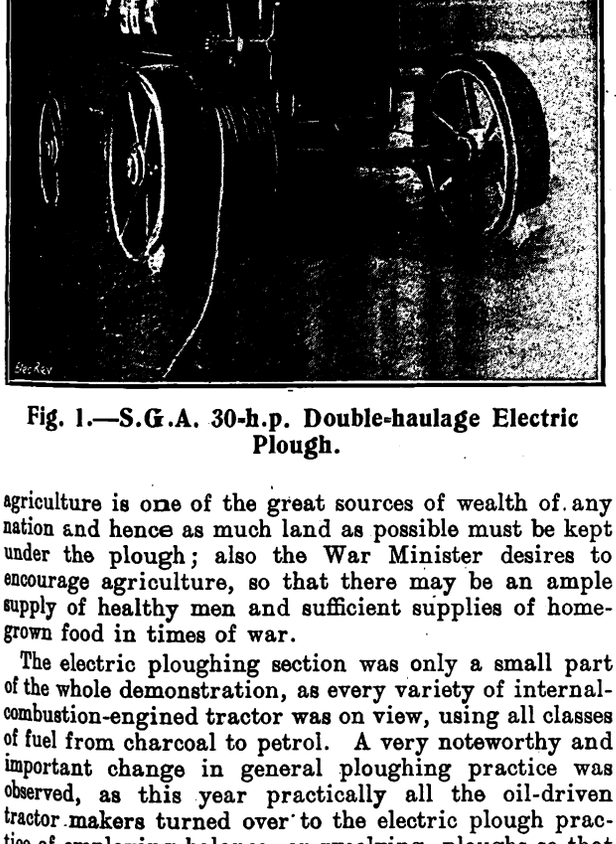

Fig. 1.—S.G.A. 30-h.p. Double-haulage Electric Plough.

agriculture is one of the great sources of wealth of any nation and hence as much land as possible must be kept under the plough; also the War Minister desires to encourage agriculture, so that there may be an ample supply of healthy men and sufficient supplies of home-grown food in times of war.

The electric ploughing section was only a small part of the whole demonstration, as every variety of internal-combustion-engined tractor was on view, using all classes of fuel from charcoal to petrol. A very noteworthy and important change in general ploughing practice was observed, as this year practically all the oil-driven tractor makers turned over to the electric plough practice of employing balance, or rveolving, ploughs so that the ploughing might be carried out continuously instead of on what the farmer terms separate "lands," *i.e.*, on two parts of the same field at the same time, so as to facilitate the turning of the tractor with its combined gear. This method undoubtedly economises time and has always been adopted in the case of electric and steam-haulage ploughing.

The electric ploughs on view ranged from 5-h.p. market-garden types to 80-h.p. giants. The Société Générale Agricole's market-garden plough is designed to operate on and from a light railway, one line of portable tram rails being laid down for the haulage set and another parallel line being provided for an "anchor" wagon; the latter was weighted by filling a tank fitted upon it with water. By means of a rope passing around a pulley attached to the tank wagon, the plough can be pulled to and fro by the haulage gear, which is equipped with two drums and a clutch, so that either of the two ropes may be hauled. The speed reduction was obtained by means of totally-enclosed worm gear. The motor itself was hardly suitable for agricultural work, as the slip rings were exposed. The plough makers had, however, put a metal shield cover over the motor, and the whole plough was covered with a roof. A very important feature of the design was that all the weight was placed very close to the ground.

The "Joya" electric plough, originally designed for vineyard purposes, has been further improved to adapt it for general field work. It was observed to be doing some excellent ploughing very easily and cleanly. It is of the round-about type, *i.e.*, the haulage gear remains in one fixed position, and is the first round-about system that has come to the notice of the writer that can be operated by one man, who follows the plough. If he wishes to stop, or reverse, the motor, all he has to do is to catch hold of the slack cable behind the plough and haul it, the strain on the rope then raises a lever under the plough gear, which disconnects the clutch on the hauling drum; hence the movement of the plough is stopped. On releasing the pull on the rope the plough goes ahead again. A very ingenious cam grip was employed for attaching the pulleys at the corners of the

Fig. 2.—Temporary 15,000-V Contact Gear.

field to the main cables, which are laid along the ends of the field, which serve as points of attachment or pull-off. When there is no strain on the cam grip it can easily be moved along the required distance for the next furrow, and, when the strain comes on, the harder the pull the

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more tightly it grips. Modern anchors of the kedge type, made of angle iron, were employed for nxing the ends of the ropes into the ground.

In the medium-power class the Société Générale Agricole exhibited a new and improved model of its 30-h.p. plough, which incorporated a number of practical improvements on last year's type. The set works on the double haulage system with the haulage drum mounted on a vertical axis under the chassis of the tackle, as is the practice when using large electric and steam ploughs. The ploughing carried out appeared to be quite satisfactory, and, in fact, was a considerable improvement on the work done by its predecessor last year, though even in that case any defects in the work were largely due to an incorrectly adjusted plough. Electric plough makers some time ago discovered that the success of their tackle lay more in the choice of a suitable plough properly adjusted than in anything else, *i.e.*, the difficulties of electric plough design lie largely outside the construction of the tackle.

There was nothing novel in the giant 80-h.p. Société Générale Agricole ploughs, as they were of a type that has now been on the market for a number of years. Incidentally, many of the mechanical portions of these ploughs are made by Messrs. Fowler, of Leeds, England.

It was very interesting to note that, while the oil-driven tractors had all their work cut out to plough up their allotted portions of land, the difficulty experienced by the electric plough proprietors was that the machines operated too rapidly to enable them to be kept in demonstration the whole time.

At one time supplies were taken off transmission lines by merely hanging hooks upon them. This, of course, is a practice to be discouraged, and the Société Electrique de Travaux Agricoles, which is the plough hiring branch of one of the big electric light companies in the area north of Paris, has designed a combined ladder and contact gear. It only requires three insulators to be left permanently mounted on a post by means of a light metal framework, and it will be appreciated that the cost of this is but little. The extending ladder and its contact gear are carried round on a portable transformer wagon.

The manufacture of the " Estrade " ploughing gear has just been taken over by the new combination of the French Thomson-Houston Co. and the Alsatian Mechanical Construction Co., whose new name is " Alsthom."

Five electric lighting companies in France have now added plough hiring departments to their businesses, and the use of electric ploughs seems to be extending very considerably in that country.

"So Near . . ."

The Problem of the Man who goes So Far . . . . and No Further.

By RIC.

ONE of our popular wireless lecturers—Sir Walford Davies, I think—has spoken of a symphony, or the spirit of its music, as " getting nearly, nearly, nearly . . . quite there," and we in the engineering world have slowly been chipping away at our methods of education until they are nearly . . . but not quite what they should be. A few alterations and several additions will have to be made before we can claim that our system is perfect.

Consider the case of a boy who has just left school and has decided that he will become an engineer. There are two distinct ways in which he may set out to achieve his object, and the distinguishing point is a hard and unfair one; but it exists, and therefore it has to be taken into account. If the boy's parents can afford it, he will do the thing in the proper, efficient, manner by going to a day college and to some sound engineering works for his training. When he has reached a certain standard, which in nearly all cases means a B.Sc. degree, he will be qualified to become, say, an assistant district engineer of an electricity supply undertaking. Surprising as it may seem, he will probably get that job without having to wait for it longer than his people can reasonably afford, and from then onwards, so far as we are concerned, his future lies in his own hands. But his parents may not be able to stand the expense to the extent that his ambitions demand, and he will have to take the alternative route, an inefficient and time-wasting one. First, he must secure a job in order to support himself, or at least bring grist to the family mill; he may start as a showroom-boy, or a wireman's mate, may even be the works' tea-boy: and it is highly probable that the more humbly he starts the greater will be his ambitions and the more compelling his desire to fulfil them. He will then commence to attend a long series of lectures at some polytechnic where evening classes are held, and the next five years or so of his life will be divided into periods of work, study, and sleep, with far too brief intervals for recreation. During that time he will, apparently, progress a good deal; actually, at the end of it he may be a fitter instead of a fitter's mate, or a works' electrician, or a switchboard " junior." He will take his final City and Guilds examination in electrical engineering, and then he will ask for promotion.

After so many years' hard grind he will feel like a man who climbs nearly to the top of a mountain and, knowing a glorious view awaits him, rests, smiling to himself in anticipation just before he reaches the summit. He will expect much, and has a right to do so. He will, in a word, expect to finish his time as a " man " and to become a " pukka " engineer. During the climb he will have noticed the men above him, the chief and his assistants, and, considering their average daily round, will conclude that—well, at any rate, his technical abilities should be quite sufficient to prevent him making a complete hash of things. At last he has qualified; he is going to become one of them, and, trying to keep his feet from floating above the floor, he walks into the chief's room for his interview.

It is just at this stage, a crisis in the man's life, that the weak spot in our system of education is likely to be revealed. As a result of that interview he may be promised one of two things: the real job that he has worked for, or merely promotion in the ranks, say, to a " senior's " position so soon as a vacancy occurs on his own switchboard, or to a similar post to the one he already holds in a more important station; and he knows well enough that when he gets such a job as that he is likely to keep it for a very, very long time before another move comes his way. Assuming the latter case, what else can be expected than that he will be puzzled and bitter, and disinclined to do more than the minimum amount of work that will enable him to hold his job?

We cannot, honestly, blame him for slacking. The pitiful thing is that, even if it occurs to him to ask, he will not find anybody who will be willing to tell him the cause of his failure, beyond, of course, the petty people who are always on the watch for a grouch against the

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"heads"; they are rarely of any use and the reasons they are likely to give are far from correct. His chief, who will know what the trouble is, will lack the courage to tell him if he is humane, and probably will not bother if he happens to be otherwise; his friends may not understand, his people at home certainly will not.

It comes to this—our engineering colleges are successful in training engineers; they are also expensive, and it follows that the men who go to them are those whose parents have been able to afford them a good general education at a secondary or public school, and they are enabled by that to make the utmost of their technical training. We have, in addition, the evening class system working, usually, in conjunction with various apprenticeship schemes; they, too, have produced many successful, even great, engineers, but they also turn out many who are neither successes nor complete failures, but who go a little way, then somehow stick and, in doing that, not only convince themselves of their own failure in their own minds, but also hold back others on the lower rungs of the ladder. So they affect the unemployment problem in engineering and, further, they may be responsible for the overflow of many below them into other professions, possibly doing the same thing themselves eventually, and in that way unemployment in general is affected. Such overflowing certainly will relieve the stress in the engineering world, in particular, when it comes, but unfortunately the relief is likely to be spasmodic and slight, for it takes a long time for a man to realise he is beaten at his own game; and every day brings more recruits to the profession.

Now, what is it that distinguishes the failure from the successful, and where does the fault lie? It is already obvious that the problem first arises when a man asks for a position of responsibility *over men rather than over things*. Not only that (a foreman enjoys such a position) but when the successful applicant will have to represent his firm both to its rivals and, above all, to the sacred person of the consumer or customer. The man who comes through that interview satisfactorily will be, must be, the one who can appreciate the average customer's point of view, can talk to him in language he will understand and like; and to whom the customer can always appeal, as to a man of understanding whom he can respect, when faced with a problem. That is a fact, whether applied to the usual type of industrial works or to a power supply company.

If we realise this, we need have no qualms about the apparent snobbishness of distinguishing between men of equal technical ability, one of whom has had a better general education than the other. Far from avoiding the question, it is the point at issue. Nowadays we no more condemn a man for his ignorant speech than for his empty pocket, yet we know whom we prefer to deal with: he who is naturally courteous and self-forgetful, or the man who is either frankly impolite or falls over himself in his anxiety to make a good impression. We instinctively turn from the jarring individual who does not seem to fit, whose ideas are disconnected and foggy, whose speech must be either vulgar or affected, and whose analogies are likely to become risky at any moment. Probably we know he is "alright—quite a decent fellow, really": in spite of that he will not do "outside." One may be sarcastic and call this "window-dressing" if one likes. It will be wrong to do so, but even then can a firm be expected to choose for its representative, either in a supply undertaking or in a city office, an unfinished product merely because he is such a worthy fellow "underneath" and so well up in his job? Do not we, or our wives, even take a little trouble to ensure that our maid speaks properly to visitors when they call?

We cannot definitely lay the blame upon anyone's conscience. It is not entirely the fault of our system of education, or of the "hard-hearted" employer. He is surely justified in taking the best men he can get from the places where they are trained. The failures themselves are a little at fault for their carelessness and lack of observation; so are the elementary schools for not driving home the fact that an educated man, in the simplest meaning of the word, is an efficient, not an effete, one. Home influence probably counts more than anything else, for a child, when free from school, naturally relaxes to the easier conditions of its home, and if those conditions are so easy as to be slack . . . there lies the greater part of the answer.

Our present system, as I have said, is not entirely to blame, but, when it is needed, there alone can the remedy be applied. Just as the E.C.A. has catered for the technical development of its future electricians and fitters by creating a special course to occupy the time between leaving school at fourteen and commencing the installation courses at sixteen, so must we afford the time to spend on our future engineers in order to make just that difference to their minds and outlook on life that will so alter their relations with their fellows, so increase and improve their friendships and widen their world, that by the time they have qualified technically they will also be fitted mentally—morally if you like—to take that all-important step further that will lift them clear of the rut.

I do not for a moment suggest anything so drastic as teaching students to walk and dance gracefully, or to write and talk "elegantly," as they taught the unfortunate "young persons" of a few years ago; nor do we want a set of superior, scornful, poets and deep-thinking élites for the engineers of the future. But I do think it is high time we taught a boy that it is perfectly safe to think clearly and accurately, speak intelligent and simple English, in pretty well whatever dialect he likes, and interest himself in things other than work and football, without becoming "pi" and swell-headed. Surely he can be taught that there are heaps of books worth reading that will interest him, which he has never seen because their very worth and fame among "literary" people have somehow frightened him off them. That is to say, by what he is told and what he is given to read he can learn to look upon himself with a little more true respect, and therefore a little more modesty, than he had been inclined to do before.

There is only one time when this work can be attempted and that is immediately he applies for admission to a technical institute. The authorities there, I think, should do their best to find out what sort of a fellow he is, and if he is below a certain standard someone wise, experienced, sympathetic, must tell him what neither his future employer, or his pals, or his people can tell him, namely, where he falls short. Then, if he is set on becoming a "pukka" engineer, a year or two spent on teaching him the gentle art of living a natural and fairly happy existence in this world of trouble and strife will be well rewarded. I say "natural" purposely, because the type of lad I have in mind leads, above all things, an unnatural life; his mind is warped, his views limited, and he has practically no encouragement to develop either among his personal friends. It is this fact that comes out in an interview and betrays in five minutes that a man would not "mix," would not fit in, and therefore must be rejected.

It will, of course, be argued that such work belongs to the schools. It does seem unfair to expect our own teachers to take on the cultivation of their men's individuality as well as the drilling of their brains; we know, too, that character is formed and tastes acquired early, and school seems to be the place in which to form them. Obviously little can be done with the hopelessly bad and probably still less with the hopelessly good, but, once again, before we censure the schools we must take into account the all-important factor of home-influence, which must handicap school teachers in unfortunate districts to an enormous extent. Home influence is stronger at an early age than after adolescence. As we have the youth during that period, when he is becoming self-critical and also inclined to note what other people think of things, relying less on the opinions of the folk at home, it is possible that we have an advantage. I believe that if those who counsel and direct the evening class system would give this matter serious consideration, fewer disappointed, mystified, and embittered failures would be left, at a critical age, either to stay in the rut and imperil the progress of their fellows, or to overflow into other already overcrowded professions.

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Electricity for the Home.

Developments at Shoreditch: Some Examples of Manufacturers' recently-introduced products.

ELECTRICITY and health go hand in hand, and it was therefore only in the natural order of things that the Shoreditch Corporation, whose motto is, appropriately, "More Light More Power," should see to it that the Electricity Department should have the largest and most prominent display at the Health and Baby week which was held recently at the Town Hall. The Department made full use of the space allotted it, with excellent results. Its exhibit was divided into three sections, *viz.*, an electric kitchen, electric fires, and miscellaneous appliances. In the kitchen continuous demonstrations in electric cooking aroused considerable interest, whilst the section devoted to electric fires attracted a good deal of attention by reason of the well-arranged display. At the back of the stand a sign representing a rising sun was erected with the slogan "Electricity is Essential to Health," written in bold letters upon it. This was illuminated by trough lighting and three reflectors which lit the sign in orange and crimson. The miscellaneous section contained a representative display of domestic appliances which included irons, kettles, toasters, vacuum cleaners, &c. In addition to the display, the Department installed an electric cooker in the Council Chamber, where a series of lectures was delivered on the operation and advantages of electric cookers.

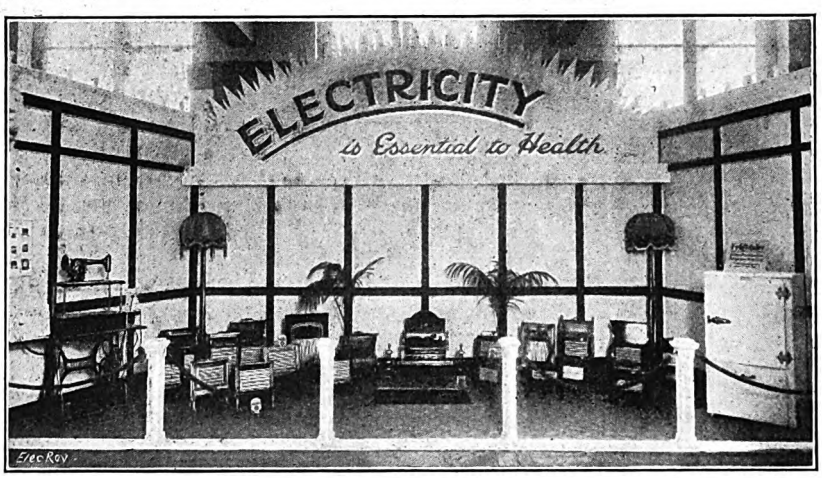

Fig. 1.—A Shoreditch Fire Display.

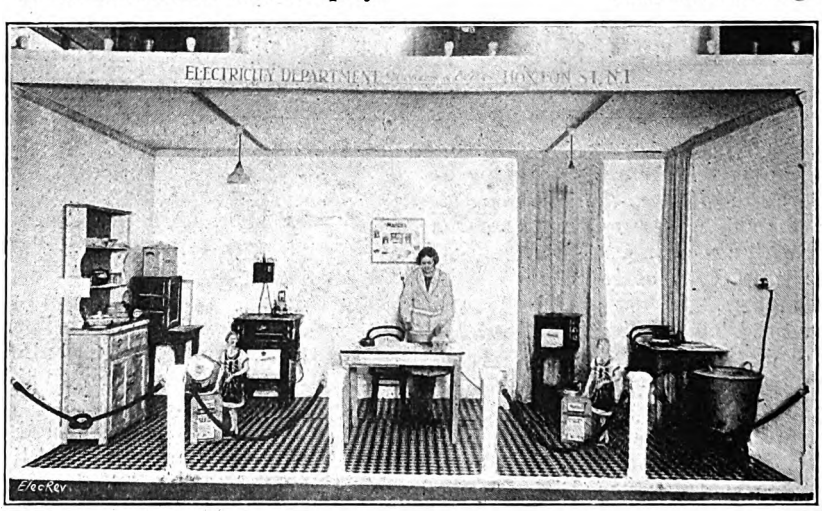

Fig. 2.—The Electric Kitchen.

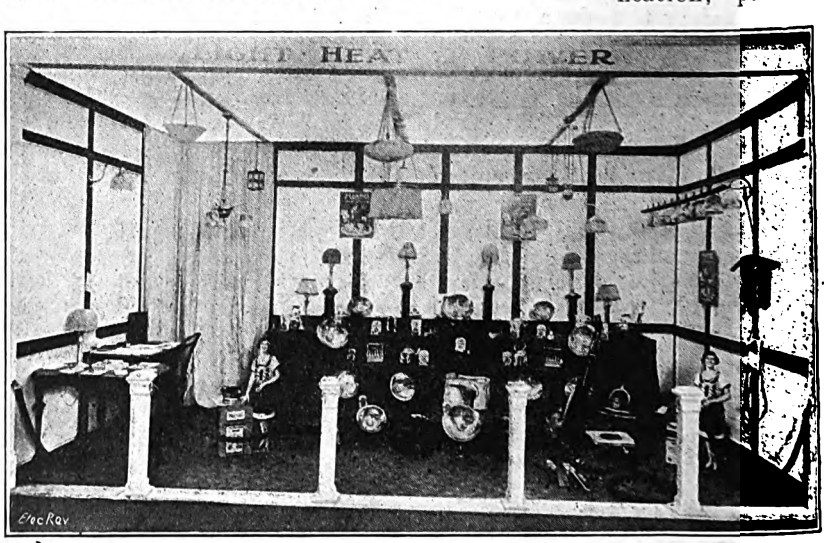

Fig. 3.—The Miscellaneous Appliances Section.

To deal with the Shoreditch undertaking's normal activities, domestic electrification was started in real earnest in November, 1926, with the launching of the assisted wiring schemes. Up to date nearly 6,700 installations have been embraced by the schemes. The actual work is done by contractors according to a schedule, and each consumer is provided with lamps and shades and a plug for small domestic appliances, all covered by a flat rate of 5½d. per kWh, which includes 1½d. for rental and maintenance. Slot meters only are used under the Council's assisted wiring schemes, and a point of interest is that consumers are allowed to pay for lamp renewals out of the meter rebates.

A feature of the service at Shoreditch is the supply to a large number of industrial-type dwellings. These are arranged in blocks of flats, and are mostly owned by the Shoreditch Corporation, the London County Council, and the City of London Corporation. Some are also privately owned. In practically all cases these flats are lighted by electricity, and in many instances electric cookers and fires are installed. It is interesting to note that no gas whatever is used in 106 tenements of the Shoreditch dwellings, and that these were lighted electrically so long as 30 years ago.

It will be appreciated that Shoreditch is a difficult area to deal with in the matter of domestic electrification, particularly so as it is not possible to conduct business along the ordinary lines as regards tariffs. In

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view of the preceding remarks, and considering that the Sales Department of the undertaking was only established at the beginning of this year, and also that the showrooms have only been in commission for about nine months, the following list of apparatus supplied by the undertaking up to the time of our visit recently augurs well for the future of the concern. About 130 cookers had been put out, 420 fires, 208 irons, and 315 kettles. The irons had all been dispatched within the previous nine months. A simple, but effective, method of propaganda is the issue of book marks to the public library.

The assisted wiring schemes were initiated by local Press publicity, but it was soon found that there was no need to continue that form of advertising. The good tidings spread, and now practically the whole of the new business of the undertaking is brought about by the enthusiasm of contented consumers. The fact that no complaints have been received by the department about the cost of electricity suggests that the charges compare favourably with those in vogue for gas supply. The gas rate is at present 3s. 7d. per thousand cu. ft. Shoreditch is proud of the fact that every thoroughfare in the borough is cabled, so that electricity supply is available to everybody.

There is at Shoreditch a special maintenance department, and again we heard of the effect of the introduction of the closed-type boiling plate on the maintenance charges. A seven day-a-week service is considered of *vital* importance, and a man is always on duty to attend to any domestic query.

"Claco" Domestic Appliances.

Messrs. Charles Lathe & Co., Ltd., Moat Foundry, Tipton, who are making a full range of electric cookers, fires, kettles, and so on, have sent us the following particulars of two selections from their range of "Claco" domestic appliances. The "Claco Suburban" cooker, fig. 4, gives a very pleasing impression of sound construction. It is built entirely of cast-iron, and is designed to meet the requirements of the small household. It possesses many features, it is claimed, which

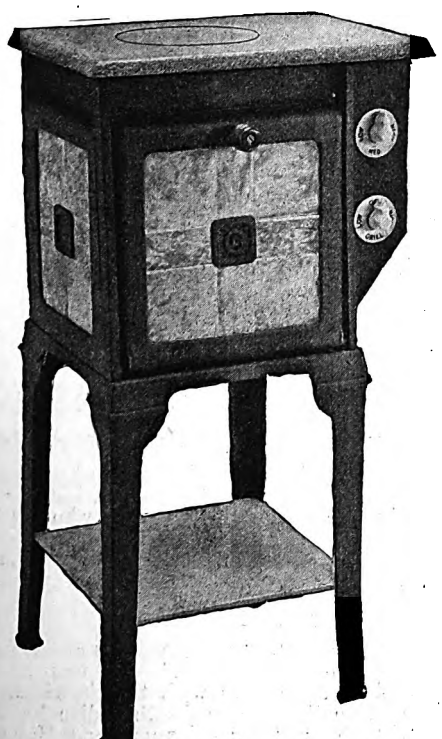

Fig. 4.—The "Claco Suburban" Cooker.

make for comfort, convenience, and cooking efficiency. The oven is fitted with top and bottom elements, each separately controlled, whilst the boiling plate is also independent. The oven has a cooking space of 12½ in. by 10½ in. by 11½ in., and the temperature can be rapidly raised to 500° F. The maximum oven loading is 1,200 watts. The door and side panel are fitted with porcelain-enamelled tiles, which not only give the cooker a handsome appearance, but also assist efficient lagging.

The "Claco Unique" fire, fig. 5, is a very attractive model; the two swing trivets are a real convenience, and everything points to this fire being one of the company's best selling lines. The matt-black body and chromium reflector supply, it is claimed, a long-felt want in elec-

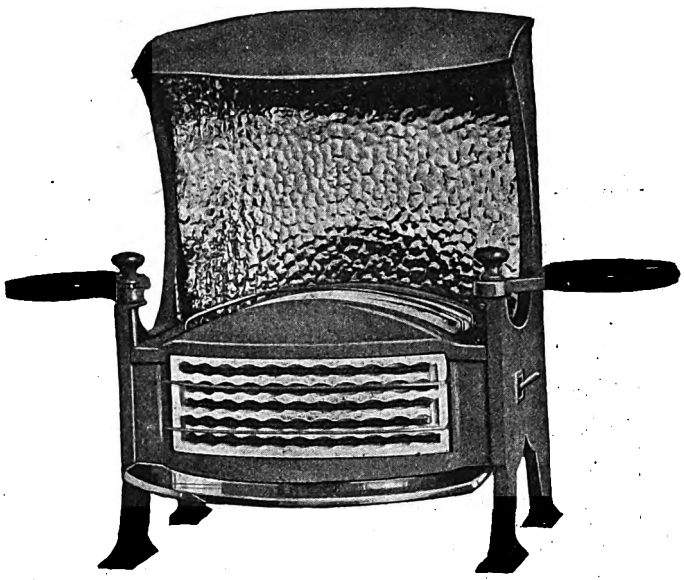

Fig. 5.—The "Claco Unique" Fire.

tric radiators. It is fitted with two 1-kW "Claco Beau" bars, and one bar is controlled by the foot press switch on the side.

New Fire Designs.

A number of new designs have been added to the range of "Alto Model" fires by the Wholesale Fittings Co., Ltd., 23, 25, 27 & 37, Commercial Street, E.1, which proved very popular last season. These fires have highly efficient elements which are guaranteed for two years and are easily removable for cleaning purposes, when necessary, without unloosening any nuts and screws. They are set in polished parabolic reflectors which shed a cosy glow when in use and throw the heat into the room. A new feature of several models is that the reflectors are chromium plated and therefore do not

Fig. 6.—A New "Alto Model" Fire.

tarnish. The fires can be supplied in a number of finishes; the illustration, fig. 6, is of No. 4694 fire, finished in art black and loaded at 1.5 kW.

A Consumer's Guide.

A useful little booklet entitled "Electricity in the Home" has been prepared by the British Thomson-Houston Co., Ltd., Crown House, Aldwych, W.C.2, which can be supplied by electricity supply undertakings for distribution to consumers. It contains information of the services and cost of electricity, instructions for reading meters, and draws attention to the correct type of fittings and lamps which should be used in any particular room. The advantages of electricity for heating, cooking, refrigeration, and other purposes are outlined, and the booklet is concluded with a number of "safety-first" hints. The cover can be overprinted to give details of the local system of supply, scale of charges, address of showroom, office, power station, &c.

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Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

Some Dangers of Rationalisation.

An address bearing this title was given on November 1st to the Oxford Luncheon Club by Sir Mark Webster Jenkinson, K.B.E., finance director of Vickers-Armstrongs, Ltd. After defining rationalisation, the speaker said that the danger of this well-advertised prescription was that it would be used as a drug to soothe the discontented, as a salve to hide the inefficiency of management, as a tonic to stimulate shareholders, and, by the amalgamation of a few individual concerns, pretend to effect a cure without actually stamping out the disease of inherited isolation which had taken control of certain organs of our industrial life. Mere amalgamation without proper co-ordination was a travesty of rationalisation. As opposed to "trustification," rationalisation sought to reduce prices to widen the market. Low selling prices might temporarily be due to low wages, low exchange rates or local conditions, but ultimately they depended entirely upon efficient production methods, standardisation, increased rate of output and elimination of waste. To capital rationalisation was a realisation of the truth that earning power was the only true measure of value. To labour it entailed some temporary suffering until as a result the increased volume of trade justified the reinstatement of displaced workers. In theory both capital and labour stood to gain by rationalisation—the danger lay in the way it was carried out in practice. After asserting that the type of director who owed his position to social and financial standing must give place to better-equipped men, the speaker said that even if the basic industries were fully rationalised under the most expert management, unless adequate working capital was provided they could not realise the best-conceived plans of their reorganisers. He suggested that for each rationalised industry an "industrial bank" should be formed which would act as a clearing house for the purpose of dealing with bank overdrafts and debenture charges, so that the provision of new capital was not hampered by their existence. The real dangers of rationalisation were that those who paid lip-service to this new industrial movement could not shake off the shackles of tradition and adapt themselves to the principles of effective reorganisation; that they would not make the sacrifices of capital, of prestige, of independent authority that followed the combination of different businesses in one rationalised unit; and that they had not the imagination, the determination, the breadth of outlook to realise what was demanded of them.

The F.B.I. Business Barometer.

The quarterly "Business Barometer" of the Federation of British Industries for the last quarter of this year says that during the third quarter of the year it was noticeable that the seasonal slowing-up of trade was less marked than in previous years. Wholesale prices of raw materials and food fell by 3 per cent. It seems probable that we are at the culminating point of what may prove to be the peak of the first major international business cycle movement since the liquidation of 1920-21. Fortunately, there is no reason to believe that the present liquidation will approach, either in intensity or extent, corresponding movements in the pre-war period or that of 1920-21. British prices during the past four years have been forced down to such a low level that, despite the unfavourable international position, British trade should continue to make fair progress in a number of directions and, in addition, should be in a specially favourable competitive position to take advantage of any improvement in the general outlook once the period of liquidation is over. Much depends on the outcome of the Government's employment schemes and to the method of settling certain outstanding industrial differences.

Czecho-Slovakian Electrical Imports.

A recent return shows that the imports of electrical machinery into Czecho-Slovakia during last year attained a value of £1,679,800 as compared with £1,620,900 in 1927. The returns also show that Germany supplied 54.4 per cent. of the imports, Austria 12.2 per cent., Switzerland 9.8 per cent., Holland 5.8 per cent., Sweden 3.7 per cent., the United States 3 per cent., France and Hungary 2.9 per cent. each, and Great Britain only 2.5 per cent. The exports of similar material from Czecho-Slovakia advanced from £611,050 in 1927 to £899,600 last year, Germany being credited with 16.9 per cent., Great Britain with 13.7 per cent., Poland with 10.6 per cent., and Jugo-Slavia with 8.0 per cent.

German Electrical Leaders' Dispute.

By a slip of the pen in our last week's leaderette bearing the above title, the phrase "German control" was used in the second line of the second paragraph, when it should obviously have been "American control."

Italian Lamp Production.

It is reported that 2,569,990 electric lamps were made in Italy in May last bringing up the aggregate for the first five months of the year to 9,404,225 as compared with 6,545,663 in the corresponding period of 1928.

American Interests in Sweden.

It is reported in Stockholm that the American General Electric is endeavouring to acquire through a Swedish bank a large block of the majority of the shares in the Allmänna Svenska Elektriska A.B. (A.S.E.A.). As the shares are distributed in small parcels among the public and the share capital is 75,000,000 kr., the acquisition of a majority would be a difficult matter.

Award for Small Lighting Plant.

The first prize and silver medal, awarded in the new implement section of the Dairy Show for an artificial lighting plant for farm buildings, has been won by Messrs. BOULTON AND PAUL, LTD., with their "Electolite" automatic lighting plant. This simple plant is a development of the original standard "Electolite," and embodies novel and outstanding features. A small battery is provided for automatic starting and supplying a few lights only—when the lighting demand increases, the plant automatically starts and continues the supply.

Chinese Cable Contracts.

It is officially confirmed that the Ministry of Communications is shortly appointing a special committee to revise cable, telephone and wireless contracts with foreign corporations.—*Reuter* (Nanking).

Estonian Foreign Electrical Trade.

According to the *Board of Trade Journal*, Estonia's imports of "electric machines, apparatus and implements" during August were valued at 191,000 kr. (£10,500), while exports of the same class had a value of 11,300 kr. (£620).

The Automobile Electrical Association.

This new trade association was inaugurated on October 24th. Membership is open to electrical repairers, but it is intended more specifically for the benefit of those who are interested in the "servicing" and repair of automobile electrical equipment. The secretary is Mr. H. Scott-Hall, 2, Tichborne Court, High Holborn, W.C.1.

Recent Contract.

BRITISH BROWN-BOVERI, LTD., informs us that it has secured the contract for the equipment of the two rectifier sub-stations required in connection with the electrification of the Madras suburban section of the South Indian Railway. The sub-stations will be located at Egmore and Minambakkam, and will each contain two 750-kW rectifier plants with h.p. and l.p. switchgear and feeder switchgear, the whole designed for automatic control. One sub-station will be fed with three-phase current at 5,000 V and the other at 33,000 V, 50 cycles, the d.c. pressure being 1,500 V. The plants have to be capable of handling very heavy overloads.

Unemployment.

The number of persons on the registers of Employment Exchanges in Great Britain showed a decrease of 549 during the week ended October 21st. At that date the total was 1,214,500, as compared with 1,215,049 on October 14th, and 1,344,187 on October 22nd, 1928.

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Control of Electricity in Spain.

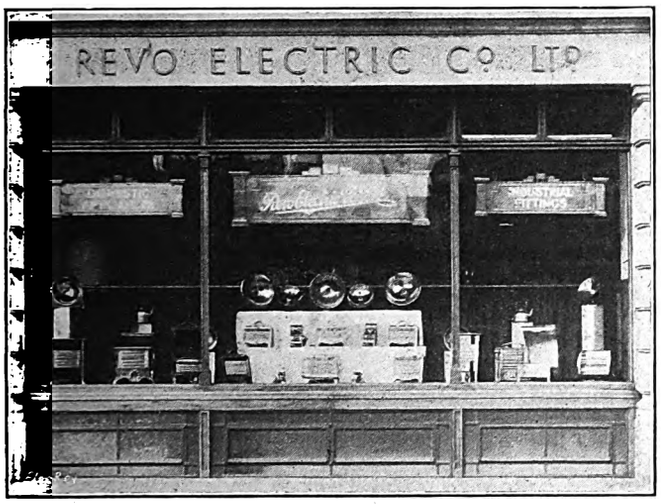
Under a recent Decree Law a "Council of Electric Energy," working under the Spanish Ministry of Public Works, is established. The duty of the Council is to investigate and co-ordinate hydro-electric schemes. The Decree Law does not apply to concessions already granted, but makes provision, in general, for State control of future developments of electric energy in Spain. A translation may be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.

The Cooking Apparatus of the "R. 101."

Referring to our notes upon the electric cooking equipment installed in the "R. 101" airship (ELEC. REV., April 26th, p. 761), the AUTOMATIC TELEPHONE MANUFACTURING CO., LTD., informs us that it supplied the equipment as sub-contractor to the Air Ministry, through the main contractors for the whole of the electrical equipment of the airship, Messrs. Haslam & Newton, Ltd., Derby, who also designed and manufactured the control switchgear shown in the illustrations.

The Revo Company's London Premises.

Extensive and modern premises have recently been opened by the Revo Electric Co., Ltd., at 30 and 31, Great Queen Street, Kingsway, W.C.2. The premises consist of a showroom, office, stores, and a garage on the ground floor and spacious stores in the basement, the whole having a floor area of approximately 11,000 sq. ft. Simplicity is the keynote of the showroom, which is attractive without being lavish.



The Revo Electric Co.'s New London Premises: Exterior and Showroom.

During the current season when heating appliances are in demand, electric fires form the bulk of the display, and many examples of the company's wide range of fires are to be seen, including the new vari-coloured enamelled fires. In addition, vitreous-enamelled wash-boilers and cookers are shown, and, of course, street-lighting fittings, which were the company's original products, form a prominent feature. The stores are separated from the showroom by the offices and run to the back of the building to a trade entrance in Parker Street. These are fitted with long avenues of shelves for the convenient storage of fires, irons, reflectors, glassware, switchgear and the many other products of the company. The two floors are connected by an electric lift.

Ericsson Telephone Acquisition.

Telefonaktiebolaget L. M. Ericsson, which last year acquired the Sievert cable works, has now taken over a small company able to supply raw materials to the combine, namely, Aktiebolaget Alpha, of Sundbyberg, near Stockholm. The Alpha company has a share capital and reserve fund totalling kr. 718,000, and manufactures machinery for testing materials, and bakelite. It is considered that the last-mentioned product is what has chiefly interested the Ericsson combine.—*Reuter's Trade Service* (Stockholm).

New Catalogues and Lists.

MESSRS. J H. TAYLOR & CO., Macaulay Street, Huddersfield.—"The Reliability Wireless Guide," containing prices and illustrations of radio components, with an electrical supplement.

IGRANIC ELECTRIC CO., LTD., 149, Queen Victoria Street, E.C.4.—A number of leaflets advertising "Igranic" radio components.

MESSRS. SIEMENS BROS. & CO., LTD., Woolwich, S.E.18.—Illustrated leaflet No. 2,065 describing the company's tee or junction box for use with C.T.S. cables.

MARCONIPHONE CO., LTD., 210-212, Tottenham Court Road, W.1.—A catalogue fully illustrated and priced of Marconi valves for all receivers.

BROOKHIRST SWITCHGEAR, LTD., Chester.—Leaflet No. 305, drawing attention to the company's switchgear.

BERRY'S ELECTRIC (1928), LTD., Touchbutton House, 85, 86 and 87, Newman Street, W.1.—A showcard, showing in rich colouring various types of "Magicoal" fires.

MARCONI'S WIRELESS TELEGRAPH CO., LTD., Marconi House, Strand, W.C.2.—Illustrated leaflets Nos. 1,082/2, 1,097, 1,101, and 1,103, dealing, respectively, with the Marconi 100-watt fixed wavelength telephone set, 500-watt telegraph transmitters, 500-watt fixed wavelength telephone set, and 1.5-kW telegraph transmitter.

Mr. T. T. D. GEESIN, 138, Glasgow Road, Paisley.—Two pamphlets describing "Sousedik" a.c. automatic starters and commutator motors.

MESSRS. J. STONE & CO., LTD., Deptford, S.E.14.—A card drawing attention to the "Twicky" high-lift hand pump.

Messrs. SIGG, LTD., 469, Holloway Road, N.7.—A series of pamphlets, &c., containing illustrations and details of aluminium utensils with machined bottoms, designed especially for employment on electric boiling plates.

Messrs. MAVOR & COULSON, LTD., 47, Broad Street, Mile End, Glasgow.—A well-illustrated pamphlet giving particulars of a new troughed-belt gate-end loader.

OWEN'S BOILER CIRCULATOR, LTD, 22, Surrey Street, Strand, W.C.2.—A booklet advertising the company's boiler circulator. Illustrated.

Messrs. BERTRAM B. FENN, LTD., "Fenbo House," Great Chapel Street, Oxford Street, W.1.—An R.A.C. report upon a trial of the "Fenbo Anti-Dazfog" automobile lamp and a coloured poster and pamphlet advertising this device.

Messrs. A. P. LUNDBERG & SONS, LTD., 477-489, Liverpool Road, Holloway, N.7.—Leaflet El. 83, describing the "Edgewise Twinob" switch, and Leaflet El. 84, dealing with 5-A and 10-A starting switches for single-phase motors.

The BENJAMIN ELECTRIC, LTD., Brantwood Works, Tariff Road, Tottenham, N.17.—Catalogue No. 1100 (108 pp.), a profusely illustrated and fully-priced list of "Benjamin" fittings and accessories for industrial and commercial electric lighting. The publication contains a considerable amount of useful data upon the subject of correct lighting.

HART ACCUMULATOR CO., LTD., Marshgate Lane, Stratford, E.15.—A showcard (15 in. by 10 in.), which has also been produced as a double crown poster, depicting a singer before a microphone with an array of "Hart" accumulators in the foreground. Also two copies of a novelty advertising starter and lighting batteries, which takes the form of a cardboard cut-out representing a motor car labelled "Your best friend's inside."

CHLORIDE ELECTRICAL STORAGE CO., LTD., Clifton Junction, near Manchester.—Leaflet No. 4059, containing illustrated particulars of the "Exide" cell filler.

Messrs. PETER BROTHERHOOD, LTD., Peterborough.—A brochure describing, with illustrations, the company's water-cooling plant.

Messrs. S. G. BROWN, LTD., Western Avenue, North Acton, W.3.—The October issue of "The Brown Budget" contains a number of articles on the company's activities.

Messrs. C. A. VANDERVELL & CO., LTD., Acton, W.3.—A poster illustrating a battery service agent recommending C.A.V. batteries.

For Sale.

Offers are invited by Salford Corporation for two marine-type water-tube boilers with stokers and forced and induced draught plant, cooling towers, and general pumping and auxiliary plant, and coal and ash conveyors. (See our advertisement pages to-day.)

Australian Duty on Radio Valves.

The application of the increased general duty of 40 per cent. on radio valves imported into Australia, decided upon some time ago, has again been postponed until July 1st, 1930. In the meantime the general duty remains at 15 per cent.

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Lectures on Lighting.

We have received from the London Lighting Service Bureau a list of lectures which it has arranged for a period of eight weeks ending December 31st. There are about 60 of these, and the organisations providing the audiences include rotary clubs, trade associations, the E.A.W., chambers of commerce, &c., in London and the provinces.

A Sadia Exhibit at Brighton.

At the electrical exhibition held recently at Brighton SADIA, LTD., had an attractive display which comprised several

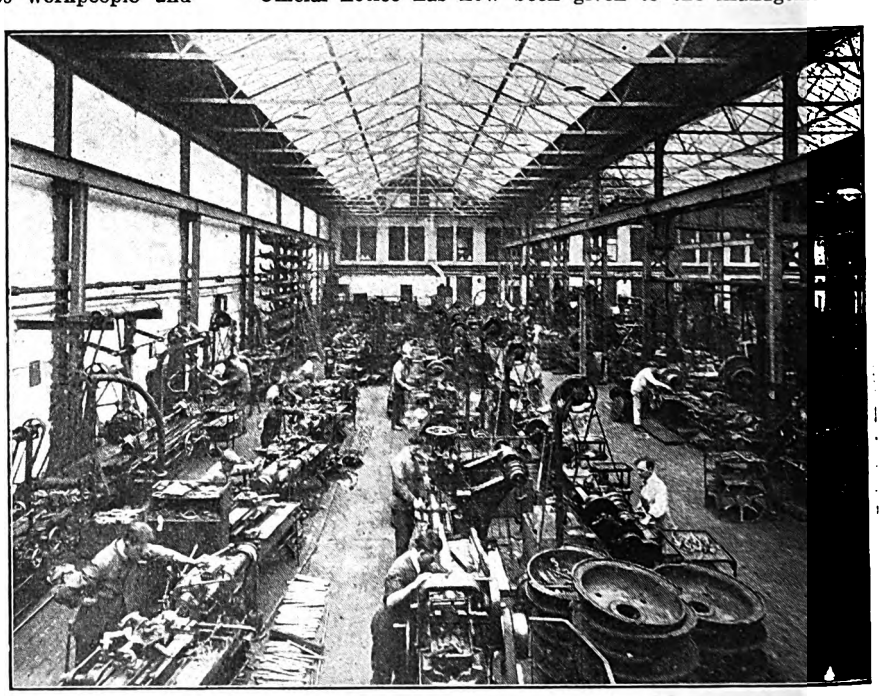
The Sadia Stand at the Brighton Exhibition.

of its automatic water heaters and other domestic appliances included in its range of products. The accompanying illustration shows the general arrangement of the stand.

Brook Motors' Works Extension.

On October 26th the directors of Brook Motors, Ltd., Huddersfield, entertained a party of nearly 400 workpeople and friends to high tea, to mark the commemoration of the twenty-first birthday of Mr. Frank Brook; Mr. Louis Brook occupied the chair. Coinciding with these celebrations was the admission of Mr. F. Brook to the business and the opening ceremony of the new extension of the works. The health of the new director was proposed by Mr. W. Mills, the secretary of the company, and Mr. F. Brook suitably responded.

Mr. Ernest Brook, founder and managing director, in the course of a speech, said that two years ago he had introduced his own system of co-partnership. In that short time 54 per cent. of the employés had taken advantage of the scheme, and he looked forward to the time when his co-partners of the workshops would be in a position to take their definite share in the management of the business. The evening was spent in dancing, whist, &c. The new extensions comprise a large showroom fronting the main roadway, in the windows of which samples of the company's products are displayed. The extension of the shops takes the form of a new wing planned for an increased output. A new system of warehousing has been devised, and will be developed, the wing being intersected by truck lines, turntables, overhead cranes, &c. The wing is so planned as to act as a connecting link between the special paint-spraying booths, the final testing beds, and the dispatch section, whilst in one portion of it motor starters will be manufactured. The output of the works is expected to be increased by 50 per cent. within a short time when the development of the new wing is completed and the new system of handling parts in progress is operating. A view of the shops is reproduced herewith.



The Works of Brook Motors, Ltd. (No. 1 Bay).

New Italian Companies.

Among the companies recently formed in Italy are the Società Compagnia Elettro-Meccanica Milanese, Milan, capital 60,000 lire; La Società Forze Idrauliche del Marecchia, Florence, capital 2,000,000 lire; La Società Applicazioni Termo-Elettriche Ing Negro, Turin, capital 60,000 lire; La Società Luce Elettrica Salemi, Salemi, capital 430,000 lire; and La Società Elettrica Valdostana, Turin, capital 100,000 lire.

New Zealand Electrical Imports.

During July last New Zealand imported electrical machinery, &c., valued at £132,780, bringing up the total for the first seven months of the year to £934,500.

Wages in the Cable-making Industry.

The Joint Industrial Council for the Electrical Cable-Making Industry notifies us that there will be no "cost-of-living" variation in wages in that industry on the third pay-day in November.

A Novel Rebate Scheme.

The rebate scheme instituted by Messrs. WILLIAM SANDERS AND CO. (which is not a limited company), to which reference was made in our last issue (p. 756), does not commence to operate until November 11th when the firm's new catalogue is to be issued.

New Swiss Contractors' Association.

With the title Verband Schweizerischen Elektro-installations firmen, an association of firms specialising in electrical installations in Switzerland, has recently been formed in Zurich (14, Schweizergasse). Among the objects of the new body are the protection of the interests of electrical installation firms and the encouragement of standard practice in the trade with regard to working conditions, estimates, and charges.

Book Notices.

MESSRS. PHILIPS LAMPS, LTD., have published a booklet entitled "Shop Window Lighting" with the object of educating electrical contractors and others in this rather intricate business which is too often treated in an unscientific manner. It deals very thoroughly with such matters as intensity, arrangement, the choice of fittings and their installation, the effects of diffused and coloured lighting and the types of installations best suited to particular trades. The publication, which is well illustrated, can be obtained from the company's headquarters, 145, Charing Cross Road, W.C.2, by any *bond fide* contractor, free of charge.

Research Papers of the U.S.A. Bureau of Standards, No. 99, "Thermoelectric Temperature Scales" (5 cents).

"Science Abstracts, A. & B.," Vol. XXXII. Part 10. October 25th, 1929. London: E. & F. N. Spon, Ltd. Price 3s. each.

The Buenos Aires Exhibition.

Official notice has now been given to the management of the British Empire Trade Exhibition, which is to be held in Buenos Aires in 1931, that the British Government has recognised the importance of the occasion, and has decided to participate on a suitable scale. The Government exhibits will be housed in one of the finest buildings in the extensive exhibition grounds, which have been generously lent by the Argen-

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tine Rural Society. The Government exhibits, besides illustrating the contributions of the British people to the world's progress, will show much of the development of British Colonies and Protectorates. The Dominion of Canada has already reserved a building of 40,000 sq. ft. area, thus demonstrating the increasing interest taken by the Canadian Government and Canadian manufacturers in South American trade.

The Blackpool Autumn Illuminations.

This year's autumn illuminations at Blackpool were more imposing than ever. Mr. C. Furness, the borough electrical engineer, spared no effort to make Blackpool better and brighter than before. Some of the settings were quite new, while some of the older settings were rehabilitated and re-equipped this year. This arrangement absorbed over 40,000 "Osram" lamps, in addition to upwards of a quarter of a million already in use. Three full miles of the promenade was illuminated, specially fashioned garlands and festoons being stretched along and across the whole width and length of the promenade. These were interspersed with special features every few yards, many of the chief vantage points presenting attractive and changing pictures of animated light and colour. The municipal lighting effects were supplemented by the special lighting schemes of hotels, places of entertainment, &c.

The IMPERIAL LIGHTING CO., LTD., also participated in the illuminations, having supplied a large quantity of its "Fairyland" strip for the purpose. This was used for most of the illuminated devices. The Swimming Baths with three electric light cascades, for which "Fairyland" strip was employed are illustrated in the right-hand figure, which has been reproduced from a photograph by the *Blackpool Gazette and Herald*.

The Blackpool Autumn Illuminations: The Town Hall and the Illuminated Swimming Baths.

Bankruptcy Proceedings.

G. F. A. STONE (trading as the Stone Manufacturing Co.), electrical accessories manufacturer, 108, Great Saffron Hill, E.C., and 422, Pinner Road, Harrow.—The accounts lodged by this debtor show total liabilities of £2,279 (unsecured £1,921), and net assets of £30, after deducting £45 for payment of the preferential claims. The Official Receiver reports that the debtor states that in June, 1920, with £150 to £200 as capital, he commenced business on his own account under the style of the General Maintenance Electrical Co., at Pinner. He shortly afterwards took in a partner and they continued trading under the same name until September, 1921, when the business was absorbed by the Modern Electric Supply Co., Ltd. He was afterwards appointed sales manager and remained with the company until it went into liquidation. In September, 1923, with under £200 as capital, he commenced business on his own account as a wholesale dealer in gas and radio goods, under the style of Lighting Supplies Co., at Finsbury Place, E.C.; this was successful, and two further shops were taken in Finsbury Place. In July, 1925, he formed the Fulston Manufacturing Co., Ltd., which took over the last-mentioned business and traded from 45, Horseferry Road, S.W.; as vendor he was allotted shares and was appointed joint managing director, which position he held until July, 1927. The company subsequently went into voluntary liquidation. In July, 1927, with £80 borrowed capital, he commenced trading as an electrical accessories manufacturer under the style of Stone Manufacturing Co., at Great Saffron Hill, E.C.; he was handicapped by insufficient working capital and ceased trading in July last, when he executed a deed of assignment in favour of a trustee, but a bankruptcy petition was eventually presented and these proceedings ensued. Since July last he has been employed as a traveller. The debtor attributes his insolvency to lack of capital; inability to obtain constant supplies of raw materials and depreciation in value of stock. The debtor attended before Mr. Registrar Mellor on October 29th, at the London Bankruptcy Court, for public examination, which was concluded.

A. K. E. STRATHDEE (trading as Emsco Radio), electrical engineer, 923, Romford Road, Manor Park.—An application was made on October 29th to Mr. Registrar Mellor, at the London Bankruptcy Court, for an order of discharge on behalf of this bankrupt, who failed last July with provable claims of £614. The Official Receiver reported that the assets, valued at £310, had only realised £55, and a further small sum might be recovered. The applicant began business in November, 1918, at 24, Leytonstone Road, E., under the style of Electrical & Mechanical Supplies Co. Four years later he started to deal in radio apparatus, and changed his trading name to Emsco Radio. He had also traded for various periods at Shaftesbury Avenue and at 100, High Road, Leyton, as the Easy-Payment Radio Co., and latterly at 923, Romford Road, Manor Park. The failure was attributed to ill-health, bad debts and depreciation of stock on account of removals and storing. The discharge was suspended for three months on statutory grounds.

R. R. WRIGHT, trading as Wright Bros., 36, Normanton Road, Derby, wireless dealer.—The first meeting of creditors was held on October 31st at the Official Receiver's office, Nottingham, when the debtor submitted a statement of affairs showing ranking liabilities of £243 and a deficiency of £97. He attributed his failure to want of capital and pressure by a creditor. He commenced trading in partnership with his brother in 1924. Each contributed £30 cash capital, and the business was successful. The other partner retired in 1925, without payment. The debtor had carried on, but had suffered in consequence of the strike of 1926. The matter remains in the hands of the Official Receiver as trustee.

IVY TURNER, wireless dealer, 103a, Little Ilford Lane, Manor Park, E.—The first meeting of creditors was held at the London Bankruptcy Court on October 25th, the debtor having filed her petition on October 14th. She states that late in 1924 she started business as a dealer in electric lamps, but later took up radio components. She met with fair success until January, 1928, when she began to feel the effects of competition at "cut" prices. She attributes her failure to lack of capital and to this competition. She estimates her liabilities at £50, and her assets at £3. The estate was left in the hands of the Official Receiver to be wound up in bankruptcy.

C. W. SANDS, High Street, Kings Langley, Herts., electrical and wireless contractor.—The receiving order herein was made on October 9th on the debtor's own petition. The first meeting of creditors was held recently at 29, Russell Square, W.C.1, when a statement of affairs was submitted showing liabilities amounting to £367 and assets of £103, leaving a deficiency of £264.

E. H. NEWMAN & M. BAYNES (Langham Radio), wireless manufacturers, 96, Regent Street, W.—First meeting held November 6th; public examination, December 6th; both at Carey Street, W.C.

H. A. HYDE, wireless dealer, late of 2, East Street, Bromley, Kent.—Bankrupt discharged subject to consent to judgment for £90.

A. LAWRIE (Houchin & Lawrie), electrical engineer, 9, Melbourne Parade, Palmers Green.—Trustee, Mr. T. Gourlay, Official Receiver, 29, Russell Square, W.C., released October 18th.

E. G. M. PAGE, dealer in wireless sets and accessories, 46, Bohemia Road, St. Leonards-on-Sea.—Last day for proofs for dividend, November 12th. Trustee, Mr. R. W. Cave, Official Receiver, 12a, Marlborough Place, Brighton.

R. BLOOD, wireless dealer and electrician, 44 and 46, Station Road, Padiham.—First and final dividend of 1s. 11¼d. in the £ payable at the Official Receiver's office, District Bank Chambers, Blackburn.

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J. A. DAVIES, electrical contractor, Eureka, Church Street, Blaenau Festiniog, Merioneth.—Trustee, Mr. J. D. Hooson, official receiver, St. Peter's Churchyard, The Cross, Chester, released October 21st, 1929.

R. L. BROCK (R. L. Brock & Co.), electrical engineer, 5, Bedford Row, Tavistock Road, Plymouth.—First and final dividend of 3s. in the £, payable November 11th, at the offices of Messrs. Bradley Hole & Co., 240, High Holborn, W.C.

Company Liquidations.

REPRODUCTION, LTD., Dysart Street, Wilson Street, E.C.2. electrical, wireless and gramophone dealers.—A meeting of the creditors in this matter was held on October 28th, the chair being occupied by Mr. H. B. Keeping, 18, Ironmonger Lane, E.C., liquidator. The statement of affairs disclosed liabilities of £6,173 all due to unsecured creditors. In addition, there were 6 per cent. debentures issued for cash amounting with interest to £506. The net assets amounted to £333. The company was formed in December, 1926, with a nominal capital of £6,000 divided into 5,000 shares of £1 each and 20,000 shares of 1s. each; 1,500 shares of £1 each and 20,000 shares of 1s. each were issued for cash. The present directors of the company were Messrs. May and Slade.

Mr. Hunter, (Wireless and Radio Trades Guardian Association), said, that that was the second occasion that the company had had to call its creditors together. In May, 1927, the creditors were asked to give the company an unlimited moratorium and that was granted. The assets at that time were about £1,124. Mr. Hunter asked if the liquidator had any figures to show whether the creditors at that date were subsequently paid any money or not. One of the directors said that those creditors were paid in full plus 5 per cent. During the discussion which ensued the validity of a debenture was questioned, but a solicitor, an unsecured creditor, said he was perfectly satisfied that the debenture was valid. Mr. Houstoun considered that the estate should be wound up compulsorily in order that a full investigation might take place especially with regard to the debentures. Several of the creditors considered that the voluntary liquidation should not be confirmed but the liquidator declared that his appointment as liquidator was confirmed on the proxies received in his favour. The following are creditors:—

	£		£
Acme Showcards ...	58	Hunt, A. H., Ltd. ...	71
Bond, V. C., & Sons ...	75	Waterloo & Sons ...	70
Chloride Electrical Storage Co., Ltd.	51	Parker, L. R.	105
General Electric Co., Ltd.	211	Rupert May & Co., Ltd.	2,636
Marconi's Wireless Telegraph Co., Ltd....	137	May, R.	706
Rothermel Corporation, Ltd.	136	Forster, P. A.	650
		Stoker, T. H. G. ...	650
		Dubilier Condenser Co., Ltd.	33
		Graham Amplion, Ltd.	35

STANDARD PLATINUM CONTACTS, LTD.—A petition for the winding up of this company has been presented to the High Court by Henrion Carbons, Ltd., electrical engineers, of Kinnaird House, Pall Mall East, S.W.1, creditors, and will be heard in London on November 11th.

BRITISH ELECTRICAL REPRODUCTION CO., LTD.—Winding up voluntarily. Liquidator, Mr. R. L. Latimer. Meeting of creditors November 12th, at 4b, Fredericks Place, Old Jewry, E.C.

UNIVERSAL & GENERAL RADIO CO., LTD.—A meeting of creditors is called for November 11th, at Revenue House, 7-8, Poultry, E.C.

CONSOLIDATED ELECTRICAL CO., LTD.—A meeting of members is called for December 6th, at the London Chamber of Commerce, Cannon Street, E.C., to hear an account of the winding up from the Liquidator, Mr. H. W. West, 31, Budge Row, E.C.

Dissolutions of Partnership.

H. V. HIRD and C. A. LAMB, ironmongers and electrical engineers, 25, Clarendon Place, Hyde, Chester.—Mr. H. V. Hird and Mr. C. A. Lamb have dissolved partnership. Debts will be attended to by Mr. Hird. Mr. Hird will continue to carry on business at 25, Clarendon Place, Hyde, in his own name, and Mr. Lamb will carry on business at 67, George Street, Hyde, in his own name.

WEBB & RODGERS, electrical engineers and contractors, 34, King Street, Bristol.—Mr. A. W. Rodgers and Mr. L. C. Webb have dissolved partnership. Mr. Rodgers will attend to debts and continue the business under the same style.

VUL-K-LEC CO., electric vulcaniser manufacturers, 58, South John Street, Liverpool.—Mr. B. Griffiths, Mr. H. de L. Crawford, and Mr. A. B. Cowie have dissolved partnership. Messrs. Griffiths and Crawford will attend to debts and continue the business in partnership with Mr. W. H. Fawcett.

MIC WIRELESS CO., manufacturers, factors and retailers of wireless and electrical components, Wellingborough.—Mr. H. Brown and Mr. G. E. Houghton have dissolved partnership. Mr. Brown will attend to debts and continue the business under the same style.

Trade Announcements.

The address of STEATITE & PORCELAIN PRODUCTS, LTD., is now Bewdley Road, Stourport, Worcs. Telephone: Stourport 111; telegrams: "Steatain, Stourport."

Messrs. V. O. GARLICK and G. H. JOY have joined the sales organisation of Messrs. Fred Dawson, Leeds, who are, *inter alia*, chief Yorkshire agents for the Metropolitan Cable & Construction Co., Ltd., and the Fuller Accumulator Co. (1926), Ltd.

The telephone number of Messrs. HOPKINSONS, LTD., has been changed to Huddersfield 3469.

MR. C. H. B. STANSFIELD, radio engineer, Beckenham, has transferred his business to 5, Kelsey Park Road.

MR. W. A. GOODHEW, electrical and radio engineer, Canterbury, has removed to 22, Sun Street in that city.

Mr. ALEXANDER AULD has commenced business as an electrical engineer at Wellington House, Alloway Place, Ayr.

The Radcliffe offices of the LANCASHIRE ELECTRIC POWER CO. have been transferred to the Kearsley power station, Stoneclough, near Manchester. (Telephone: Farnworth 495.) All correspondence relating to the Kearsley, Radcliffe and Padiham power stations should be sent to the new address.

Carron Company announces the appointment of Mr. JOHN NORMINGTON as representative for the sale of "Carron" electric cooking and heating products in the Yorkshire area. Mr. A. V. GULLY, until lately provincial sales manager for Kelvinator, Ltd., has been appointed representative in the South and West of England. Mr. J. S. NISHOLLS, who has up to the present been responsible for this area, will in future be attached to London office.

The Southampton branch of the GENERAL ELECTRIC CO., LTD., has been removed from 24 to 149, High Street, Southampton. The telephone numbers are now Southampton 5631-3.

Mr. THOMAS T. D. GEESIN, 138, Glasgow Road, Paisley, informs us that pending the formation of a new company to manufacture "Sousedik" motors and starters in this country, he is in a position to quote for this equipment.

The EDISON SWAN ELECTRIC CO., LTD., has recently opened new offices and stores at 9, Whimple Street, Plymouth, under the supervision of Mr. W. A. Maddick, Southampton depôt manager.

MR. C. E. HART, A.M.I.E.E., 82, West George Lane, Glasgow, has been appointed representative for handling the transformer products of the British Electric Transformer Co., Ltd., in Scotland and Northern Ireland. Mr. Hart is a past president of the West of Scotland Branch of the A.M.E.E.

Social Events.

One hundred and thirty members and guests were present at a supper in connection with the Electrical Department of Devonport Dockyard which was held at the Duke of Cornwall Hotel, Plymouth, on October 26th. The superintending electrical engineer, Mr. H. F. Hunt, was in the chair, and the guests included the director of electrical engineering at the Admiralty, Mr. W. McClelland, the Admiral Superintendent of Devonport Dockyard, Vice-Admiral O. Backhouse, and the Mayor of Plymouth, Mr. Ambrose Andrews.

The annual staff dinner of British Insulated Cables, Ltd., was held on October 28th, at the Adelphi Hotel, Liverpool. About 650 sat down to an excellent dinner, at which there were no long speeches. The large number necessitated the employment of two rooms. Mr. G. H. Nisbett, the managing director, in one, and Mr. J. A. Smith, director, in the other, proposed the toast of the Company, and in a very few words emphasised their wish that many more of these "happy family" gatherings would be held, and that the company would continue its present prosperity, which would be reflected in the maintained welfare of every individual member of the staff. After dinner a concert for those who preferred this kind of entertainment started without delay, and dancing commenced for others. After the excellent concert most of the audience flocked to the ballroom.

Prices of Materials.

Messrs. F. Smith & Co. report, November 5th: Copper (electrolytic bars), £84, 10s. dec.; ditto ditto sheets, no change; ditto ditto wire rods, £94, £4 dec.; ditto ditto h.c. wire, no change.

Messrs. James & Shakespeare report, November 5th: No change in the prices of copper bars (best selected), sheet, and rod; English pig lead, £23 15s., 20s. dec.

Messrs. Edward Till & Co. report, November 5th: India-rubber, Para fine, 9¼d., ¼d. dec.

Messrs James Forster & Co., writing on November 2nd, report a fall in lead prices last week. They say that the Producers' Association made no attempt to support the falling market, with the result that prices fell to a level at which consumers were ready to make purchases. A considerable business was done on the fall but, now that consumer's demands are satisfied, it is not at all unlikely that prices will go even lower as producers are freely offering lead at present levels.

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Lighting and Power Notes.

Argentina.—BUENOS AIRES.—To meet the ever-growing demand for power supply in the Buenos Aires district, the Compania Hispano-Americana de Electricidad "Chade" has decided to install an additional 52,000-kW turbo-generator set.

Australia.—VICTORIA.—It is reported by *The Eletrical Engineer of Australia and New Zealand* that, after protracted negotiations, the Victorian Electricity Commission has entered into an agreement with the Electric Supply Co. of Victoria, Ltd., for the purchase of the electricity supply and tramway undertakings operated by the company in the cities of Ballarat and Bendigo. The company's various franchises expire in 1931 and subsequent years, and the Commission desires to take over the electricity supply undertakings and operate them as a part of the State electricity supply scheme. The Commission did not wish to take over the tramway undertakings, but it will have to do so as the company cannot operate them alone and the respective city councils do not want them because they are not paying at present. The agreement that has been made has to be submitted to the State Parliament for ratification. The purchase price will be £272,000, due for payment on June 30th, 1934, and the Electric Supply Co. of Victoria will be reimbursed for all approved capital expenditure from March 31st, 1927, to the date of signing the agreement. The Commission is at present constructing the first section of a transmission line from Melbourne to Bendigo, which will ultimately form portion of a 66,000-V ring main extending from Melbourne through Bendigo and Ballarat. The work of constructing this ring main is to be accelerated, in order that a supply of electricity from the State generating stations may be given to Ballarat and Bendigo as soon as possible.

Barking.—LOANS SANCTIONED.—The Urban District Council Electricity Committee has received sanction to loans of £1,200 for buildings, £16,870 for mains and services, £4,875 for transformers and switchgear, and £950 for house-wiring installations.

Bath.—NEW PLANT.—The Corporation Electricity Committee has recommended that application be made for sanction to the borrowing of £35,829 for new plant, mains and sub-station.

Burnley.—MAINS EXTENSIONS.—The Corporation Electricity Committee recommends the extension of mains at a cost of £1,608.

Carlisle.—MAINS EXTENSIONS.—The Corporation Electricity Committee has authorised mains extensions to cost £2,688.

Chelmsford.—CHANGE OF FREQUENCY.—The Corporation Electricity Committee has received a letter from the Electric Supply Corporation, Ltd., stating that it cannot bind itself to any definite maximum rates if the Council agrees to its suggestion that the cost of the change of frequency should be met by a sinking fund. A letter has also been received from the Central Electricity Board stating that it is unable to contribute towards the cost of the change of frequency, as the case of Chelmsford was fully considered by the Electricity Commissioners when the South-East England Electricity Scheme was prepared. The Committee has recommended that a deputation be appointed to wait upon the Electricity Commissioners to discuss the question of the proposed change of frequency, the question of charges, the adequacy of supply, the advisability of purchase, and generally as to the whole matter of supply.

Continental.—FRANCE.—The Société l'Energie Electrique du Rhin has placed the contract for the supply of the hydraulic and electrical equipment for the new hydro-electric power station on the Alsace canal at Krems with the Société Alsacienne de Constructions Electriques, of Belfort, and the Société Alsthom, of Paris, with which it is associated. The plant will comprise five vertical-shaft turbines coupled to 8,800-V, 50-cycle generators, each having a capacity of 31,000 kW.

The report of the Société d'Electricité de Paris for the year ended June 30th last shows that the output during the twelve months amounted to 307,115,613 kWh, as compared with 282,633,812 kWh in 1927-28. In order to meet the increasing demand, a second generating station is to be erected at St. Denis. Although it will at first only be equipped to the extent of 50,000 kW, the building is to be designed to accommodate plant producing 350,000 kW.

POLAND.—It is reported that three new foreign groups have come forward with schemes for the electrification of the regions of Posen, Pommerellen, and the western districts of Congress (old) Poland, and have applied for a concession on the same basis as that suggested by the Harriman group. The proposal made by the latter is shortly to come before the Economic Council of the Polish Government.

Eastbourne.—LOANS.—The Corporation Electricity Committee is to apply for sanction to the borrowing of a further £25,000, for mains and services, and £5,000 for sub-station extensions.

Greasby.—ELECTRICITY SUPPLY.—The Parish Council has accepted the offer of the Birkenhead Town Council to give a supply of electricity to the village by means of overhead lines.

Grimsby.—PLANT EXTENSION.—The Town Council has decided to apply for sanction to extend the plant at the local station at an estimated cost of £63,000.

Guildford.—STREET LIGHTING.—The Corporation Electricity Committee is applying for sanction to a loan of £4,770 for street lighting purposes.

Lichfield.—EXTENSION OF SUPPLY AREA.—An extension of the town's electricity scheme has recently been made to the village of Shenstone.

Northern Ireland.—LARNE (CO. ANTRIM).—It is expected that the new plant at Curran Point, which will supply about 2,000 square miles of County Antrim and County Derry with electricity, will be in operation by the end of this year.

Oldham.—THE RATABLE VALUE CHARGE—The Corporation Electricity Committee has decided that the ratable value system of charging for electricity shall only apply to dwelling-houses of a ratable value of £10 and upwards, or, alternatively, that occupiers of dwelling-houses of a ratable value of less than £10 shall only be supplied at this tariff, on their agreeing to pay 20 per cent. of an assumed ratable value of £10, plus ½d. per kWh for all energy consumed.

Price Reductions.—Reductions in charges for electricity have been made or recommended in the following districts:—

SUTTON COLDFIELD.—Lighting: under 750 kWh per quarter, from 5½d. to 5d. per kWh; from 751 to 2,000 kWh, from 5½d. to 4½d.; over 2,000 kWh, 4d. per kWh (unchanged). Special contract rate applicable only where electricity is used for lighting, heating and cooking or storage water heating: a fixed annual charge of 12½ per cent. of the ratable value of premises supplied, payable quarterly in advance (minimum ratable value £18), plus ¾d. per kWh for all electrical energy consumed. Heating and cooking; under 2,000 kWh per quarter, from 1¾d. to 1½d. per kWh; over 2,000 kWh, from 1½d. to 1d. Power: under 500 kWh per quarter, from 2d. to 1¾d. per kWh; 500 to 5,000 kWh, from 1¾d. to 1½d.; 5,001 to 10,000 kWh, from 1½d. to 1¼d.; first 10,000 kWh for consumers of upwards of 10,000 kWh per quarter, from 1½d. to 1¼d.; all energy consumed in excess of 10,000 kWh, from 1¼d. to 1d. per kWh.

BASINGSTOKE.—The following new scale of charges has been introduced within the borough:—Private lighting: up to 250 kWh per quarter, 6½d. per kWh; next 250 kWh, 6d.; any additional energy, 5½d. Public building lighting: up to 250 kWh per quarter, 6d. per kWh; next 250 kWh, 5½d.; any additional energy, 5d. Outside lighting: Flat rate of 5½d. per kWh. Power, heating and cooking: up to 500 kWh per quarter, 2½d. per kWh; next 500 kWh, 2¼d.; next 1,000 kWh, 2d.; next 3,000 kWh, 1¾d.; next 5,000 kWh, 1½d.; any additional energy, 1¼d. per kWh. New tariffs corresponding with those mentioned above have been introduced for rural district consumers. Domestic tariff for borough consumers only: Fixed charge of 10 per cent. per annum of the ratable value, one-fourth of which is payable quarterly, plus ¾d. per kWh consumed for all purposes. Consumers under annual contract: Fixed charge, plus ¾d. per kWh. Domestic tariff for rural district consumers: Fixed charge of 3d. per watt per annum connected for lighting purposes only up to 3 kW (with a minimum of 10s. per quarter), plus 1¾d. per kWh consumed for lighting and all domestic purposes.

LONG EATON.—Lighting: From 6d. to 5½d. per kWh. Power: Sliding scale of 2d. to 1d. per kWh., according to the number of kWh consumed.

Ribchester.—ELECTRICITY SCHEME.—An electricity scheme estimated to cost about £5,000 was considered at a parish meeting held recently. The adoption of the Kohler system was suggested, involving the provision of a power house. Canvassers have been appointed to see if the necessary capital will be forthcoming.

Shipley.—THE RATABLE VALUE CHARGES.—The Urban District Council Electricity Committee, upon consideration of an anomaly which occurred through the recent reduction under the ratable value system of charging for electricity for domestic supplies and combined house and shop premises, has agreed that the minimum fixed half-yearly charge should be 17s. 6d. in the case of domestic consumers and £2 2s. in the case of house and shop consumers.

South Shields.—YEAR'S WORKING.—In his report for the year ended March 31st last the borough electrical engineer (Mr. J. Edgar) states that the total revenue amounted to £106,704, as compared with £116,396 in the preceding year. Working expenses totalled £50,864, as against £49,312, leaving a gross profit of £55,839 (£67,084). After providing for capital and other charges there was a net surplus of £10,230. The electrical energy sold increased from 10,597,778 to 11,053,150 kWh. Additional consumers to the number of 1,532 were connected during the year under the assisted wiring scheme.

PUBLIC LIGHTING.—The Corporation Lighting Committee has adopted a scheme for the conversion of all street gas lamps to electricity at a cost of £42,865.

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APPARATUS PURCHASING SCHEME.—The Corporation Electricity Committee has adopted a scheme whereby consumers who have prepayment meters installed will be enabled to purchase lamps or other small electrical apparatus, the payment for which will be recovered from the rebate due to the consumer on his meter being read.

Special Orders.—Applications are to be made to the Electricity Commissioners for Special Orders by the Carlisle Corporation to supply electricity in the rural districts of Brampton and Longtown and a part of the rural district of Carlisle, and by the Kettering Urban District Council to supply electricity in various parishes in the rural districts of Kettering, Gretton, and Oxendon.

Stoke-on-Trent.—ELECTRICITY SCHEME.—As a result of the linking-up of Stoke-on-Trent and Leek, a distribution scheme for the supply of Stockton, Brook and Endon has been prepared. The estimated cost is between £6,000 and £7,000.

Torquay.—BULK SUPPLY.—The Corporation Electricity Committee has decided that, in accordance with the terms of the agreement for bulk supply to the Teignmouth Electric Lighting Co., Ltd., a further cable be provided to give a supply to the company at the boundary of the urban district of Newton Abbot and the parish of Haccombe-with-Combe, near the sewerage works of the Newton Abbot Urban District Council.

LOAN.—The Committee is seeking sanction to a loan of £15,000 for unspecified works in connection with l.p. mains and services throughout the area of supply.

Tynemouth.—LOAN.—The Corporation Electricity Committee is applying for sanction to a loan of £10,000 for mains and services.

United States.—ELECTRICAL DEVELOPMENTS.—According to *Power* the addition of 86,000 h.p. to the hydro-electric development of the upper Hudson River, 52,000 h.p. of which will be secured by enlargement of the noted Spier Falls plant, is planned by the New York Power and Light Corporation. With the addition, Spier Falls will become a 100,000-h.p. station, bringing the total installations of the Mohawk-Hudson system to more than 550,000 h.p. Further power expansion in the upper Hudson River district is forecast in recent reports that the Mohawk-Hudson Corporation is negotiating with the Union Bag and Paper Company at Hudson Falls, for power rights, which involve the construction of a new plant at Fenimore to develop 75,000 h.p. The addition to the Spier Falls plant is to be completed for service in December, 1931, and is expected to cost more than $1,000,000.

Wick.—POWER STATION EXTENSIONS.—The Town Council has decided to extend its power station by the installation of an additional oil engine at a cost of £2,485.

Tramway and Railway Notes.

Australia.—MELBOURNE.—We have received from the Melbourne and Metropolitan Tramways Board (chief engineer: Mr. T. P. Strickland) a copy of his report, together with a statement of accounts for the year ended June 30th last. The total revenue from the electric tramways amounted to £1,629,470, as compared with £1,602,068 in the preceding year. Working expenses totalled £1,086,048, as against £1,057,066, leaving a gross profit of £542,522 (£545,002), which was carried to the net revenue account, together with a gross profit of £196,250 from the cable tramways, and a deficit of £7,902 from the 'buses, making a total of £730,870 available. After providing for capital and other charges, there was a net surplus of £384,986, as compared with £445,178 in 1927-28. The total capital expenditure up to June 30th amounted to £7,719,026, of which £5,941,319 has been spent on the electric tramways. The number of passengers carried increased from 132,805,672 to 133,831,902, and the car mileage from 15,215,696 to 15,640,465. During the year plans and specifications for the conversion of the Victoria-Collins Street cable system to electric traction were completed, and the contract of the Victorian Construction Pty., Ltd., for the necessary work was accepted. The conversion is expected to be completed by December 7th of the current year. Over three miles of new track were constructed during the year and approximately eight miles of single track reconstructed.

Bournemouth.—RAILLESS CARS.—The Corporation is to apply for Parliamentary powers to run railless cars on all tramway routes throughout the borough.

Brighton.—DOUBLING OF TRACK.—The Corporation Tramways Committee has decided to seek permission to the doubling of the single track in North Road, at an estimated cost of £4,500.

Leicester.—RAILLESS CARS.—The Tramways Committee has recommended the City Council to apply for sanction to substitute railless cars on existing tramway routes and to run 'buses outside the city.

Llanelly.—TRAMWAY ABANDONMENT.—The Town Council has decided to abandon its tramway system and substitute railless cars.

Newport (Mon.).—PROPOSED TRAMWAY ABANDONMENT.—The Town Council is considering a proposal to substitute 'buses for trams on the service between the Newport boundary and the centre of the town, along Chepstow Road.

Telegraph and Telephone Notes.

Australia.—INTER-STATE COMMUNICATION.—The federal public works committee has recommended the establishment of a telephone service between the eastern states and Western Australia. It is proposed to use the two existing 300-lb. copper telegraph lines for the provision of a voice-frequency telephone circuit. The telegraph traffic will then be carried on high-frequency carrier channels upon the present physical lines, which will provide one voice-frequency telegraph channel, eight duplex telegraph channels allowing 16 messages to be sent simultaneously, and one reserve wire between Port Augusta and Kalgoorlie. As the telegraph traffic increases it will be possible to add two additional duplex telegraph channels without incurring further capital expenditure at any point between Adelaide and Perth, and as the telephone traffic increases two additional telephone channels can be made available without further capital expenditure on buildings, power plant, transmission, maintenance, or apparatus; all that will be necessary will be another wire on the existing poles. The capital cost of putting the scheme into effect is anticipated to be £69,800. The estimated annual charges of the system are £49,300, and the estimated annual revenue is, according to the *Electrical Engineer of Australia and New Zealand*, £55,000, of which, it is expected, the telegraph service will contribute £42,000 and the telephone service £13,000.

France.—"RADIOROUTES."—A system which is expected to assist air navigation have been described in a lecture before the French Academy of Sciences. The principle may be applied either to light or wireless waves; it is a development of the system already in use by which beams from two lighthouses are employed to direct ships at sea, the beams crossing at a known distance from the shore. Mr. William Loth, the French inventor, now claims to have produced means of synchronising the rotation of the lighthouse beams in such a way that they meet always on a given line of route, even over long distances, and though the route be complicated by turns.—*Reuter's* (Paris).

Italy.—TELEPHONY.—The Società Telefonica Interregionale Piemontese e Lombarda is taking over from the Italian Government the working of telephone communication service between Italy and Switzerland, *via* the Simplon route.

Sierra Leone.—TELEPHONE SERVICE.—The annual administrative report on the railway system for the year 1928 indicates that the telephone and telegraph section (including the electric train staff system) comprised a total of 1,866 miles of lines, compared with 1,547 miles in 1927. The number of circuits on the Freetown exchange was 138, an increase of 18, and in addition there were 38 circuits on the Hill Station exchange, an increase of 13. The military exchange was closed, and those military telephone circuits which were required to remain in use were transferred to the civil exchange. A 50-line c.b. exchange was installed in the new Government offices as well as a system of intercommunicating telephones in the building.

Telephone Statistics.—WORLD DEVELOPMENT.—The chief statistician of the American Telephone and Telegraph Company has compiled figures for comparison (1928) that show the total number of telephones in the world to be 30,990,304. Of those 18,522,767, or 59.8 per cent., were in the United States; Europe claimed 8,623,407, or 27.8 per cent., while the remaining countries, Asia, Africa, Oceania, and the entire Western hemisphere outside of the United States, had 3,844,130 telephones, or 12.4 per cent.; Great Britain's share was 1,633,802, or 5.27 per cent. In relative development, as in number, the United States, with 15.8 telephones for each 100 of its people, leads the world; Canada is second with 13.2 telephones per 100 of population, then New Zealand with 10.0 per cent., Denmark with 9.3, Sweden with 7.7, and Australia with 7.2 per 100; Great Britain, with 3.6 per 100, is tenth on the list in relative development, immediately above the Netherlands and Finland. Turning to individual cities, San Francisco, with 32 telephones per 100 of population, has the highest development. Stockholm is second with 28.8, and American cities occupy the next nine places. London is twenty-fifth with 7.7, and, even among European cities, can only claim eleventh place with the capital cities, Stockholm, Oslo, Copenhagen, Berlin, and Paris all being above it. Most British cities are well below a development of five telephones per 100 of population. It is noteworthy that, with the exception of the United States, Canada, New Zealand, and the Scandinavian countries, telephone service is still predominantly confined to urban areas. In the matter of telephone conversations per head of population per annum, Britain still retains a very humble position. The United States again leads with 224.7 conversations; Canada is a good second with 221.5, and

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New Zealand third with 178.9. Then come the three Scandinavian countries of Denmark, 136.8; Sweden, 114.6; and Norway, 72.6; and in the thirteenth position Great Britain, with 28.6, immediately below Japan and Germany. Thus it appears that the people of the United States make eight times more use of their telephones than the people of Great Britain.

Radio Notes.

Canada.—STATION RE-STARTS.—In response to a great number of letters from listeners in Eastern Canada and to a petition signed by 4,000 citizens and presented to the company by the Amateur Radio Association of Montreal, the Northern Electric Company's broadcasting station (CHYC) resumed broadcasting recently, says *World-Radio*, on 775 kc (411 m). Local programmes will emanate from the new studios in the uptown district, connected by special wires to the transmitting station, just completed, at Ste. Hyacinthe, sixty miles south of Montreal, where the Northern Electric Company has installed plant rated at 5 kW, but modulation is so high (99 per cent.) that the effective power is equal to 20 kW.

France.—SHORT-WAVE STATION.—The conversion of the Eiffel Tower into an ultra-short wave station for colonial purposes has been considered for some time. The present Postmaster-general favours it, and about 1,500,000 fr. has been earmarked as the cost of the necessary installation. General Ferrié, who is at the head of the French military wireless services, admits, however, that the trials made up to the present have not given much satisfaction. An aerial is now being erected at the summit of the tower, near the lightning rod, and it is hoped that thereby better results will be obtainable. The General says, according to the *Wireless Trader*, "if the tower under present conditions should prove unsuitable for ultra-short wave work, we will at once attempt to find a more suitable site, as it is absolutely essential that a great French station of this sort should be established."

Holland.—RADIO INTERFERENCE.—Owing to the continued disturbance caused by train wires, illuminated advertisements, &c., to wireless reception, the Netherlands Union for Radio Telegraphy is making new efforts to bring about the formation of a permanent bureau for combating such disturbance, and has approached all broadcasting societies in the Netherlands with a view to obtaining their co-operation.

Spain.—STATION RE-OPENED.—The second Union Radio Broadcasting station in Barcelona, Radio Catalana, has recommenced transmission. It will be remembered that it was forced to close down some months ago on account of defects in the new 10-kW transmitter.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—December 10th. Posts and Telegraphs Department. Switchboard keys and parts. (B.X. 5776.)* Electric lamps, lamp caps, and lamp sockets for telephony purposes. (B.X. 5783.)*

December 17th. Telephone fuses, heat coils, and protectors. (B.X. 5784.)* Loading-coil pots. (B.X. 5785.)* Secondary batteries. (B.X. 5777).*

January 7th. Telephone hand sets (B.X. 5823).* Contract pressure testers. (B.X. 5821.)*

January 14th, 1930. Ringing motor-generator sets for automatic telephone exchanges. (B.X. 5839.)* Telephone indicators. (B.X. 5822.)*

November 27th. Victorian Government Railways. Indication transformers for railway signalling, with a no-load ratio of 100/6 V. (B.X. 5737.)*

March 30th.—D.c. neutral relays for power-signalling purposes. (B.X. 5793.)*

December 9th.—State Electricity Commission of Victoria. 3,000-kVA transformers and spares. (B.X. 5775).*

January 13th, 1930. 2,200-V switchgear and accessories. (B.X. 5827.)*

SYDNEY.—December 16th. Public Works Department. Electrically driven pumping for the Junce Water Supply. (A.X. 8740.)*

Bridgend.—Mid-Glamorgan Water Board.—CORRECTION.—The note regarding this undertaking's requirements which appeared in our issues of October 25th and November 1st was incorrect. The contract was for the erection of a pumping station, including the *installation* (not supply) of the electrical plant mentioned.

Colwyn Bay.—November 16th. Urban District Council. Supply, erection and laying of e.h.p. and l.p. overhead lines and cables in connection with Glan Conway and Llysfaen electricity supply. (See this issue.)

Edinburgh.—November 11th. Parish Council. Installation of Lancashire boiler, &c., at Craiglockhart Poorhouse. Schedules from Mr. J. M. Johnston, 47, Charlotte Street, Leith.

Egypt.—CAIRO.—November 30th. Ministry of the Interior. Diesel engine-driven electric lighting installation at Abou-Tig (Assiut Province). (B.X. 5791.)*

December 28th. Ministry of Public Works. Electric generating and pumping sets for Mankabad Barracks. (B.X. 5842.)*

Fife.—November 20th. Education Authority. Electrical work at reconstructed Cowdenbeath School. Schedules (£1 1s. deposit) from Mr. George Sandilands, architect and master of works, Education Offices, Kirkcaldy.

India.—DELHI.—India Stores Department. November 14th Crude-oil engine-driven d.c. generating set and a motor-generator set, with switchgear, for the Military Engineering Services, Razmak. (B.X. 5744.)*

November 15th. Bombay, Baroda, and Central India Railway Co. Primary battery, supplies, gasfilled and vacuum lamps, overhead contact wire and stranded catenary cable. (November 1st.)

November 22nd. South Indian Railway Co., Ltd. Madras electrification. Switchgear for stations (lighting, power, and signalling). (See this issue.)

Lancaster.—November 16th. Electricity Department. Supply of medium tension 4-core, paper-insulated, l.c. steel tape armoured cables. (See this issue.)

London.—HANWELL.—November 23rd. Managers of the Central London School District. Motor with reduction gearing, starter, &c. (November 1st.)

New Zealand.—March 11th. Public Works Department. 110-kV switchgear for interconnecting auto-transformers for the Waikato power scheme. (B.X. 5797.)* Switchgear and controlling equipment for Timaru. (B.X. 5798.)* 66-kV switchgear and protective system for Lyttleton, Lake Coleridge scheme. (B.X. 5796.)*

November 12th. New Zealand Government Railways. Air compressors, machine tools and electric motors. (A.X. 8736.)*

WELLINGTON.—November 12th. Railways Department. Telegraph line material. (B.X. 5824.)*

Post and Telegraph Department. January 13th, 1930. Four point jacks. (B.X. 5840.)*

November 12th. V.i.r. cable. (B.X. 5826.)*

CHRISTCHURCH.—November 23rd. City Council. Pump and electric motor. (A.X. 8737.)*

Salford.—November 25th. Corporation. Electric travelling and slewing jib crane. (See this issue.)

South Africa.—JOHANNESBURG.—November 14th. S.A. Railways and Harbours Board. Telephone cable, terminal strips and paper sleeves. (B.X. 5813.)*

BLOEMFONTEIN.—December 2nd. Waterworks Department. Two low-lift and two high-lift electrically-driven pumping units, with cables, starters, &c. (A.X. 8710.)

December 2nd. Municipal Council. Copper conductors, poles, transformers, switchgear. (B.X. 5825.)*

PRETORIA.—December 27th. Posts and Telegraph Department. Telegraph material. (A.X. 8734.)*

CATOOMA, RHODESIA.—December 12th. Municipal Council. Two boilers, steam engines, alternators and switchboard. (A.X. 8749.)*

Stockport. — December 2nd. Electricity Department. Supply, delivery and erection of 6,600-V switchgear. (See this issue.)

Stone.—November 25th. Electricity Department. E.h.p. overhead 11,000-V transmission line (2,300 yd.); two 50-kVA sub-stations, and l.p. overhead distribution services (1,400 yd.), &c. (See this issue.)

Turkey.—ANGORA.—November 16th. Intendance de l'Administration des Postes, Télégraphes and Téléphones. Telephone wire, cable boxes and insulators. (B.X. 5846.)*

Warrington.—November 18th. Electricity Department. E.h.p. sub-station switchgear. (November 1st.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

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Contracts Closed.

Barking.—Electricity Committee. Recommended :—
1,500 yd. of .1 sq. in. cable (£690).—Derby Electric Cables, Ltd.
1,100 yd. of .25 4-core cable (£918).—Ateliers de Constructions Electriques de Charleroi.
Switchgear (£107).—Pooley & Austin.

Birkenhead.—Electricity Committee. Accepted :—
15,850 yd. l.p. cable (£3,545).—W. T. Glover & Co., Ltd.
5,000 yd. l.p. cable (£1,189).—Hackbridge Cable Co., Ltd.
Four miles l.p., single core, v.i.r. cable (£569).—Liverpool Electric Cable Co., Ltd.

Blackburn.—Accepted :—
Electric lighting installation at the Customs and Excise offices.—T. Blackshaw.

Carlisle.—Electricity Committee. Accepted :—
E.h.p. switchgear (£7,962).—British Thomson-Houston Co., Ltd.
Feed water and blow down piping (£398).—J. Spencer, Ltd.
Extension to low pressure piping (£378).—Pratchitt Bros., Ltd.
Large steam and water valves (£953).—Dewrance & Co.

Glasgow.—Electricity Committee. Recommended :—
Double-tier switchgear (£536).—A. Reyrolle & Co., Ltd.
10-amp., 250-V meters (£587).—Electrical Apparatus Co., Ltd.
Electric crane (£385).—John Grieve & Co.
Replacement of 12 motors (£326).—Crompton Parkinson, Ltd.

Tramways Committee. Accepted :—
Brake-testing machine.—J. Robertson.

Halifax.—Town Council. Accepted :—
Electrical work for the filter house (£268).—Gath Electrical Engineering Co., Ltd.

Ilford.—Electricity Committee.
200-kVA transformer (£128).—Foster Engineering Co., Ltd. (Accepted.)

London. — SOUTHWARK. — Electricity Committee. Accepted :—
Replacement of condenser tubes (£337).—Harland and Wolff, Ltd.

WESTMINSTER.—Middlesex County Council. Accepted :—
Cable for Porters Park Asylum (£275).—Hackbridge Cable Co., Ltd.

EAST HAM.—Electricity Committee. Recommended :—
500-kW mercury arc rectifier (£2,395).—British Brown-Boveri, Ltd.

LONDON COUNTY COUNCIL.—Education Committee.
Electric lighting at Baring Road school, Lewisham (£215).—Stegman & Co. (Accepted.)
Electrical work at extension of Trade School for Girls, Bloomsbury (£337).—Coleby & Co. (Accepted.)

Manchester.—Electricity Committee. Accepted :—
Weldless steel spigot and faucet tubes.—Stewarts & Lloyds, Ltd.; British Mannesmann Tube Co., Ltd.
High pressure steam pipe work at Barton station.—Aiton and Co., Ltd.

Gas Committee. Accepted :—
Electric lift for waterless gasholder at Bradford Road works.—R. & J. Dempster, Ltd.

Education Committee. Accepted :—
Electrical installations.—At North Manchester High School for Boys, R. Seddon & Sons; at Birchfields Road school, Brookes & Co., Ltd.

Tramways Committee. Accepted :—
Electric tram rail welding equipment.—Equipment and Engineering Co., Ltd.
Trailer vehicle for rail welding equipment.—Eagle Engineering Co., Ltd.
Two rail grinding machines.—Rail Welding Co., Ltd.
Permanent way special trackwork.—Titan Trackwork Co., Ltd.

Oldham.—Education Committee. Accepted :—
Motors for machines in spinning department of Technical College.—English Electric Co., Ltd.; British Thomson-Houston Co., Ltd.; Metropolitan-Vickers Electrical Co., Ltd.; and Siemens-Schuckert, Ltd.
Wiring at Municipal Technical College.—W. Caton & Sons.
Electric lighting installation at new clinic, Scottfield.—S. Charlesworth & Co.

Paignton.—Electricity Committee. Accepted :—
Street lamps in Esplanade Road and Totnes Road (£260).—Paignton Electric Light & Power Co., Ltd.

Portsmouth.—Electricity Committee. Accepted :—
E.h.p. and l.p. cable for extensions to Sarisbury.—Johnson & Phillips, Ltd.

Torquay.—Electricity Committee. Accepted :—
Spare apparatus and accessories for turbo-alternator (£482).—British Thomson-Houston Co., Ltd.

Tynemouth.—Electricity Committee. Accepted :—
Switchboard for Ingleside sub-station (£79).—J. H. Holmes & Co., Ltd.
1,650 yd. cable (£389).—Macintosh Cable Co., Ltd.

West Ham.—Board of Guardians. Accepted :—
Installing fire alarms at Whipps Cross Hospital (£246).—Andrew Miller.

Forthcoming Events.

International Commercial Motor and Transport Exhibition.—November 7th-16th. Olympia, W.

Nottingham Society of Engineers.—Friday, November 8th. Mechanics' Institution. 7 p.m. "Power Production—Past, Present and Future." Professor F. C. Lea.

Illuminating Engineering Society.—Friday, November 8th. Royal Society of Arts, Adelphi, W.C. 6.30 p.m. "The Nature and Effects of Glax." Mr. W. S. Stiles.

Physical Society.—Friday, November 8th. Imperial College of Science, South Kensington, 5 p.m. Ordinary meeting.

Institute of Wireless Technology.—Monday, November 11th. Engineers' Club, Coventry Street, W. 7 p.m. "Maintenance of a Modern Broadcasting Station." Mr. Noel D. Cumming.

Institution of Electrical Engineers.—Informal meeting, Monday, November 11th. Institution, London, W.C. "Temporary Expedients in Engineering." Mr. W. E. Highfield.

(North-Eastern Centre).—Monday, November 11th. Armstrong College, Newcastle-on-Tyne, 7 p.m. "The Heating of Buildings Electrically by means of Thermal Storage." Lieut.-Col. S. E. Monkhouse and Mr. L. C. Grant.

(North-Midland Centre).—Tuesday, November 12th. Hotel Metropole, Leeds, 7 p.m. "Feed Heating by Extracted Steam in Generating Stations." Mr. E. J. Evans.

(North-Western Centre).—Tuesday, November 12th. Engineers' Club, Manchester, 7 p.m. "The Modern use of Pulverised Fuel in Power Stations." Mr. R. A. Chattock. (Joint meeting with the North-Western Centre of the Institution of Mechanical Engineers.)

(North-Western Students' Section). — Thursday, November 14th. Engineers' Club, Manchester, 7.15 p.m. "That the Present Tendency to Transfer Transport from Rail to Road be Deprecated."

(Scottish Centre.)—Tuesday, November 12th. Royal Technical College, Glasgow, 7.30 p.m. Address by the chairman, Mr. G. Morgan.

(South Midland Centre).—Monday, November 11th. University, Birmingham, 7 p.m. "Voltage Control of Large Alternators." Mr. H. W. T. Taylor.

(Western Centre).—Monday, November 11th. Merchant Venturers' Technical College, Bristol. Ordinary meeting.

(Dundee Sub-Centre).—Thursday, November 14th. University College, Dundee, 7.30 p.m. "The Economic Combustion of Coal." Mr. A. Erskine.

Association of Consulting Engineers.—Wednesday, November 13th. St. Stephen's Club, Victoria Embankment, S.W. 7 p.m. Annual dinner.

Institution of Railway Signal Engineers.—Wednesday, November 13th. Institution of Electrical Engineers, Victoria Embankment, W.C., 6 p.m. "Specification, Installation and Maintenance of Power Signalling Installations." Mr. H. W. Moore.

Institution of Welding Engineers.—Thursday, November 14th. Caxton Hall, Westminster, S.W.1. 7.30 p.m. "The Manufacture and Standardisation of Eye-protective Glasses." Dr. W. M. Hampton.

British Institute of Radiology incorporated with the Röntgen Society.—Thursday, November 14th. 32, Welbeck Street, W., 8.30 p.m. Ordinary meeting.

Electrical Power Engineers' Association (South Wales Section).—Thursday, November 14th. Grand Hotel, Cardiff, 8 p.m. "Electrical Advertising and Flood Lighting." Mr. Lingard.

(Derby and District Section).—Thursday, November 14th. Black Boy Hotel, Nottingham, 7 p.m. Annual general meeting.

(London Technical Group).—Tuesday, November 12th. Junior Institution of Engineers, 39, Victoria Street, S.W., 7.15 p.m. "Modern Steam Generators." Mr. P. E. Rycroft.

British Electrical Development Association.—Friday, November 15th. Royal Society of Arts, John Street, Adelphi, W.C., 7.30 p.m. "Selling Time Switches." Mr. E. E. Sharp.

Midland Electrical Engineers' Ball.—Friday, November 15th. Grand Hotel, Birmingham.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, November 16th. South Wales Institute of Engineers, Cardiff, 6 p.m. "Electrical Measuring Instruments." Mr. R. H. Morgan.

(Western Sub-Branch).—Saturday, November 9th. Swansea. "The Problem of Peak Loads." Mr. G. E. Heder.

Association of Supervising Electrical Engineers.—Saturday, November 16th. Ye Mecca Restaurant, Ludgate Hill. Whist drive, dinner and dance. Tuesday, November 19th. Junior Institution of Engineers. 7.15 p.m. Lecture on "The Development of Generation and Distribution of Electricity in the British Isles." Mr. Archibald Page, M.I.E.E.

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The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of makers of the following:—

"BURMAN" electrical horse-clipping machine.

Notes.

Diesel Engine Users' Association.

Before a well-attended meeting of the Association on November 1st, 1929, Mr. J. G. Pearce, M.Sc. (director, British Cast Iron Research Association), read a paper on "Modern Engineering Cast Irons and their Properties." Experience has resulted in divergent views on the best type of structure to withstand wear, and upon the most desirable composition. Some of the differences are doubtless due to the effect of melting conditions. Metallurgists have for some time appreciated that the structure of cast iron, which determines its mechanical properties, is governed in part by composition and in part by the rate of cooling. From recent work carried out by the Cast Iron Research Association it is now clear that a third factor has to be added, namely, melting conditions. The author concluded that British iron-founders are capable of producing castings to meet the most stringent demands of the engineer, but that they make a good casting the primary consideration and not a high-strength test bar.

Fuel Research Report.

On October 25th the "Report of the Fuel Research Board for the year ended March 31st, 1929," was published (H.M. Stationery Office, price 2s. net).

In the course of the work in the various laboratories it not infrequently occurs that some observations are made, or experience gained, that may be of considerable interest, but still not be such as to be suitable for publication as a technical paper. Some such results are published from time to time in the technical Press, or in papers read by members of the staff at meetings of societies, and these are mentioned in the appropriate sections of the report, and a list is given in Appendix III. The report deals more fully with results of this nature than has been the case in past years; also a somewhat fuller summary than usual of some of the aspects of the work that has been carried out since 1924 is given. The report is divided, as usual, into sections under general headings, but these necessarily overlap. Fuel research can be divided broadly into two parts—on the properties of the coal available in the country, and on the processes to which it is subjected, either during or before its utilisation. The investigations on carbonisation, carried out by the Fuel Research Station, by the Gas Industry, and by the Coke Research Committees, suggest that satisfactory coke may perhaps be made from a wider range of coals than has hitherto been realised, but only if the process is adapted to the characteristics of the coal used. It is not always possible to vary details of the process in use, so as to get the best results when the properties of different consignments of coal vary, and it is becoming increasingly evident that uniformity in the coal, as regards inherent quality, ash content, and grading into sizes, is in many cases more important than, within limits, the quality itself.

One of the most difficult practical questions dealt with has been that of sampling commercial consignments, and considerable differences of opinion have manifested themselves as to the size of gross sample it is necessary to take to get a truly representative laboratory sample for analysis. Where the whole consignment dealt with consists of graded coal of uniform quality, comparatively small samples are sufficient. Where, on the other hand, the consignment consists of "run-of-mine" coal, or of the products of several seams, or even of several pits, taken at random and with no attempt at mixing, a very large gross sample is necessary to ensure that the final analysis is representative of the bulk. For this reason, also, uniformity of supply is desirable.

Fatality.

An inquest was held at Brixton on October 30th, on William Edgar Barratt (35) who was found dead in his bath with severe burns from a portable electric stove. His wife found him in a kneeling position in the bath, with his face resting on a bowl fire. Dr. William G. Stone, divisonal police surgeon, said that Barratt was perfectly healthy and had died from electric shock. He suggested that deceased was handling the heater while he was in the bath and fell. As he did so the current went from either his face or his hand to his feet which were in contact with the bath. Mr. Bateson, representing the South London Electric Supply Corporation, Ltd., said that the voltage was 220. A formal verdict was returned.

Educational.

A special course of six lectures on "The Principles and Practice of Electric Welding," and a similar course of five lectures on "Pulverised Coal" will be held on Friday evenings (7 p.m.), commencing November 8th, and Wednesday evenings (7.15 p.m.), commencing November 6th, respectively, at the School of Engineering and Navigation, High Street, Poplar, E.14. The fee for residents in the L.C.C. area for each course is 3s. 4d.

Woodpecker Stops Electricity Supply.

The Newark electricity supply was cut off for four hours recently owing to the persistency of a woodpecker. Newark receives its supply in bulk from Spondon by overhead cables, and it was discovered that one of the poles had been so damaged by a woodpecker as to make it unsafe. The woodpecker had bored a hole of a diameter of 3½ in. right through the pole, and then had delved down 18 in. in the heart of the pole where she built her nest. This being discovered, the hole was filled in with concrete, but the bird pecked all round this until she had loosened it and then pushed the solid mass out of the hole. The pole had to be replaced.

H.P. Laboratory in Belgium.

The Société des Ateliers de Constructions Electrique has lately completed a 450,000-V testing laboratory at its works at Charleroi, Belgium. According to the company's house organ, the installation comprises three 150,000-V monophase transformers, coupled in series, and a 600,000-V transformer divided over three horizontal cascade-coupled elements arranged one above the other in an oil-containing receptacle. Voltages are measured by adjustable ball spark gaps, by Sterzel or Abraham-Villars electrostatic voltmeters, or by the Haefely method. Dielectric losses are measured by means of a Schering bridge.

Appointments Vacant.

Electrical engineer for the Mains Department of the Calcutta Electric Supply Corporation, Ltd. Junior shift engineer for the Gravesend Corporation. Electric cooking demonstrator (female) for Newport (Mon.) Corporation. Meter and instrument tester for Preston Corporation. Clerk of Works (£220) for the Llantarnam U.D.C. Electricity Scheme. Lady demonstrator of domestic electrical appliances (£156-£182) for the Southampton Corporation Electricity Department. Junior technical officer (£175+) for the Admiralty Experimental Section, Portsmouth. (See our advertisement pages to-day.)

International Electrotechnical Commission.

A meeting of the Advisory Committee on Measuring Instruments of the International Electrotechnical Commission is meeting in Berlin this week to prepare recommendations for submission to the National Committees in regard to electricity meters. Lt.-Col. Kenelm Edgcumbe, R.E. (T.), past-president of the Institution of Electrical Engineers and honorary secretary of the I.E.C., is acting as leader of the British delegation, which includes Mr. G. A. Cheetham, Mr. E. Fawssett, Dr. E. H. Rayner, and Mr. R. H. Schofield. Delegates from the principal countries will be present in Berlin for this meeting, which is preparatory to a full meeting of the Commission to be held in Scandinavia in June, 1930. Professor C. Feldmann, president of the I.E.C., and Mr. C. le Maistre, general secretary, are attending the meetings. A meeting of the Advisory Committee on Aluminium is also being held, at which Mr. E. Painton and Dr. E. H. Rayner are acting as British delegates.

Ford Orders a Large Generating Set.

Mr. Henry Ford has ordered from the American General Electric Co. a turbo-generator rated at 110,000 kW, which will be installed by the Ford Motor Co. in the power station at its River Rouge plant, Fordson, Michigan. The power generated by the new set will be used in the manufacture of Ford automobiles. One of the important features of the design is the small amount of space which will be taken up by the new set. The overall dimensions are 57½ ft. long by 23 ft. wide and 21 ft. overall height.

Tokio Engineering Congress.

In the presence of a distinguished gathering Prince Chichibu opened the World Engineering Congress on October 29th, in which 48 countries are participating. Of the big overseas delegations, the American numbers 133 members, the British 53, the Chinese 46, and the German 37. Approximately 800 papers by some of the world's most eminent engineers are being laid before the Congress, which ends on November 11th. An elaborate programme of entertainments has been prepared by the Japanese hosts. During the same week the Prince also opened the sectional meeting of the World Power Conference. —*Reuter's* (Tokio).

Whitworth Scholarships and Prizes.

Among the successful entrants to the 1929 competition for Whitworth scholarships (£125 per annum for three years) and Prizes (£10) were the following dockyard electrical fitter apprentices:—Scholarships: J. W. H. Freebody and R. F. Beaton, both of Portsmouth. Prizes: F. L. Weatherdon and W. G. Lucas, both of Devonport.

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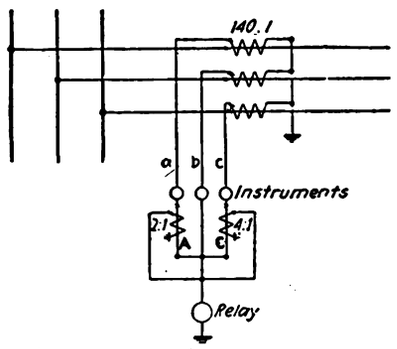
The Use of Wood in Electrical Engineering.

At a recent meeting of the Société Française des Electriciens, M. Vitte, one of the engineers of the Société Générale de Constructions Electriques et Mecaniques (Alsthom), of Paris, read an interesting paper on the use of wood in electrical engineering, in which he described some of the methods employed in his company's laboratory for determining the dielectric properties of treated woods and the best methods of drying timber intended for electrical purposes. The dielectric tests are carried out by means of a compensated a.c. wattmeter, it having been found that with d.c. the exterior surface of the wood presents a marked resistance to the passage of the current, whereas with a.c. the superficial layer, in conjunction with the current-connecting electrodes, acts as a condenser. Tests have been made with machined pieces of yoke elm and beech wood measuring about 1 3/5 by 1 3/5 by 20 in., both in the direction of the fibre and transversely. As regards the impregnation of wood, which is usually done under pressure, Mr. Vitte stated that better results were obtained with green than with dried wood. Impregnation has, however, not proved a sufficient protection against the effect of moisture, and consequently the Alsthom Co. now uses dried wood coated with Indo-Chinese lacquer, which is giving good results, even in the case of wood containing from 10 to 12 per cent. of moisture.

Conversion of Single- to Three-phase Protection.

The *Electrical World* refers to a problem which arose on the system of the Commonwealth Edison Co. of converting single-phase pilot-wire relay protection for 66-kV underground lines to three-phase protection. The standard method of three-phase protection, using three relays, would have necessitated the replacement of the pilot cable because of the lack of a sufficient number of conductors, but a scheme was devised whereby, with the addition of two current transformers, the three-phase protection was obtained with only one relay. For simplicity the explanation deals with the scheme applied to a line on which simple overload relays were used.

The current transformers "A" and "C," being of unequal



Transformer and Relay Connections.

ratios, produce at all times a neutral current. It is this characteristic of the system which effects protection for all types of faults.

The short-circuit current was assumed to be ten times full-load current for each type of fault. The unbalancing effect produced by current transformers "A" and "C" will give unequal tripping time for different combinations of the phases involved in phase-to-phase and phase-to-ground short circuits, if an induction-type relay is used. The time taken by the relay to operate varied from 0.43 second with a C-phase to earth fault to 1.60 seconds for a B- to C-phase fault. This time differential is not considered objectionable in the majority of cases, but it can be obviated by the use of an instantaneous relay. Proper selectivity will be maintained between lines with the unbalancing current transformers, because the same degree of unbalance will be established over the whole system.

Electrometer Voltage-Transformer Testing.

The determination of the ratio and phase-angle errors of instrument voltage-transformers at the National Physical Laboratory has always been carried out by electrostatic methods. The radio test has been made by directly comparing the primary and secondary voltages, the former being measured by a reflecting electrostatic voltmeter readable to 0.01 volt, in conjunction with an accurately divided high resistance used as a voltage divider; while the latter, which is commonly 110 volts, is measured directly by the same voltmeter. The measurement of phase angle has been carried out with a reflecting quadrant electrometer, the quadrants of which are excited by an auxiliary voltage, while the needle is connected alternately to the secondary winding and to the tap point of a voltage divider across the primary winding of the transformer. With steady voltage and suitable instruments the measurement of ratio is very satisfactory, the results obtained being consistent and accurate to within 1 or 2 hundredths of 1 per cent. The method of phase-angle measurement is accurate to within about 2 minutes, and has been quite adequate for a number of years. Recently, however, the standard of performance of voltage transformers has been considerably improved, and it has seemed desirable to employ a method of calibration which should be more precise. The method described in a recent issue of the I.E.E. *Journal* was used by Mr. R .S. J. Spilsbury, B.Sc., A.M.I.E.E., some six years ago, but was not adopted for routine testing in view of the fact that the phase angles of transformers then met with were too large to justify measurement to an accuracy greater than 2 minutes, while a very high sensitivity was actually somewhat of a disadvantage. The method is essentially a deflectional potentiometer method using a heterostatically-excited electrometer as indicator.

The mean discrepancy between the electrostatic and comparison methods, having regard to sign, is 1 part in 100,000 for ratio, and 0.08 min. for phase angle, the maximum values being 3 parts in 10,000 and 0.3 min., respectively. In view of the fact that the tests were made on different days, and that the discrepancies, therefore, include any variation in the transformer characteristics with time, the agreement must be regarded as very good. In the case of phase angle it is better than the probable errors of the methods would suggest, and is, therefore, partly fortuitous; for ratio, however, it is believed that such precision can be regularly obtained, and similar results have been secured at 33,000 volts. It has, of course, to be remembered that the errors of the voltage divider have been deliberately excluded from the above comparison by using the same divider in each test. It is concluded that no serious systematic errors are likely to exist in the electrostatic method described.

World Power Bibliography.

World Power is compiling for the World Power Conference a bibliography of publications on power and related subjects, with special reference to electrical power. The bibliography will be circulated to all the members of the Conference in 48 countries, numbering many thousands of members. The compilers are in need immediately of catalogues and literature of books published during the current year on the subjects enumerated below:—Electro-technics; hydro-electric development and water storage; railway electrification; power station design; electricity in agriculture; industral applications of electricity; low-temperature carbonisation; metallurgy; training of engineers; administration of electrical utilities; economics of electricity manufacture and supply. The bibliography will deal only with books originated in, and relating to, the British Empire, *i.e.*, it will not include books first published in the United States and re-published in Great Britain.

Radium for Poland.

It is reported from Washington, U.S.A., that President Hoover has presented Mme. Curie with £10,000 for the purchase of radium. "We give Mme. Curie a welcome from people who are grateful for the beneficient service she has rendered mankind," declared the President. "As an indication of the appreciation and respect our people feel for Mme. Curie, generous-minded men and women under the leadership of Mrs. William B. Maloney have provided funds to purchase a gramme of radium to be used in the research hospital which bears her name in Warsaw." Mme. Curie had already received a gramme of radium for French hospitals.

Electric Welding of Bridges.

Under the title of "Electric Welding as applied to Bridges and other Structures on the London & North-Eastern Railway," Mr. Harold Bruff recently read a paper before the Junior Institution of Engineers which made public for the first time the results of experiments and researches conducted by him and the Bridge Engineers' Department of the Northern Section of the L. & N.E.R. on the applicability of the electric arc in depositing metal and welding together the members of bridges and other iron and steel structures. Being a frank sceptic of the possible advantage of the system, the work done and tested on his railway had made him an enthusiast on its immense possibilities as both a time and money saver. The system employed was the quasi-arc in which the structure to be strengthened or repaired constituted the negative pole of the circuit and the metal electrode formed the positive pole. It appeared that though the poles might be reversed or alternating current used, the metal would still flow from the electrode to the work, and not *vice versa*. The most suitable voltage was between 30 and 60, and the current between 100 and 105 amperes per welder. The great advantage of welding was its non-interference with the use of the railway line by traffic, and the success which had been achieved on old works had led his company to employ the method of the "fabrication" of new steel structures with equally good results; the principle had also been applied to the building up of worn points and rails at cross-overs with much success. Elaborate tests had been made by his company, and at Armstrong College, Newcastle, to determine the relative tensile strengths of joints made by riveting and welding, nearly all of which indicated the superiority of the latter, provided the work was done by a careful operator using an electrode of the appropriate size and quality. Detailed statements of all the costs involved in carrying out the work were given, from which it appeared that both in strengthening old structures and in executing new work the cost of welding was well below the cost of riveted work.

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The George Montefiore Foundation.

As is known, in his will, the late George Montefiore bequeathed a sum to provide a triennial prize to the best contribution to the scientific or technical advancement of electricity. The decision is made by a jury appointed by the administrators of the bequest, the Association des Ingénieurs électriciens sortis de l'Institut électrotechnique Montefiore, Liége. This year the prize (amounting to about 29,000 fr.) has been divided between four entries (out of a total of 22); they are Messrs. Algeri Marino (Rome), H. Parodi (Paris), Pestarini (Paris), and Evans and Wagner (Pittsburgh). The next competition will take place in 1932.

Marine Oil Engines.

The Richardsons-Westgarth oil engine was described in detail by Mr. W. S. Burn, M.Sc., in 1926 before the North-East Coast Institution of Engineers and Shipbuilders. The author recently read another paper before the Institution in which he outlined the progress that has been made since that date and the modification of design found to be necessary as the result of experience. Finally, the scope of Richardsons-Westgarth oil engine was dealt with; particulars were given of the different types available, and some mention made of the new short-stroke designs which are being evolved. Typical examples of possible installations were given, ranging from one for a trawler to one suitable for a passenger liner with Diesel-electric drive.

Extensions at Stoke-on-Trent.

The new extensions to the Stoke-on-Trent Corporation's power station were formally inaugurated on October 30th in the presence of a large gathering of members of the Corporation, station engineers, &c. Ald. H. Leese, J.P., who is both chairman of the Electricity Committee and of the North-West Midlands Joint Electricity Authority, opened the main door of the boiler house, and the company proceeded to the new 12,500-kW turbo-alternator, where the Lady Mayoress, by pressing a button, turned on the steam to the new turbine. This was followed by the closing of the switch of the new set by Ald. Hassall and the subsequent inspection of the station by the visitors, after which the party drove to the Town Hall for tea, the chairmon of the Electricity Committee presiding. The chairman said that the ceremony was in the nature of a valedictory one, because in April next the power station would be handed over to the control of the North-West Midlands Joint Electricity Authority as one of the stations under the national "grid" scheme. Referring to the history of the station, he said that erection was commenced in 1912, and the first section opened in 1913 with two 1,500-kW sets. With the new plant installed, the station now had a capacity of 37,500 kW. When the station was first opened 6½ lb. of coal were required to generate 1 kWh. whilst the present figure was 1.82 lb. It was anticipated that, with the new set, a better result still would be obtained. Although the Potteries might not obtain the benefits they anticipated under the National scheme, they had the consolation of knowing that they were helping other districts to obtain an adequate supply of electricity cheaply. He referred to the all-electric houses in the city, and expressed the hope that smoke in the Pottery towns would eventually disappear. The thanks of the city were due to Mr. C. H. Yeaman, city electrical engineer, for his work in connection with the electricity undertaking.

Institution Notes.

Institution of Electrical Engineers.

INFORMAL MEETING.—On October 28th the first informal meeting of the 1929-30 session was opened by the president of the Institution, Colonel Sir T. F. Purves, who, in the course of his remarks, said it would be appropriate if they had a talk about the policy of industrial undertakings in the matter of deliberate and systematic research. The commanding position among industrial nations occupied by Great Britain in the latter half of the nineteenth century undoubtedly produced a kind of soporific effect and encouraged the idea that things would go on all right if left alone. Scientific discovery was looked upon as something that had naturally to be left to those who took a special interest in it. The shock of modern international competition came as a rude awakening and showed that others had been more ready to recognise and use the fundamental discoveries of science as a basis for industrial progress. The formation of the Department of Scientific and Industrial Research, as a national institution, was an event of great significance, and it would continue to keep British industry anchored upon science, but it was not enough. Those admirable supplementary bodies, the British Electrical and Allied Industries Research Association and its counterparts in other main branches of industry, were not enough. There would always remain a mass of practical problems that any industrial undertaking, which aspired to be a pioneer and to regain and hold the markets of the world for this country, must solve in detail for itself. The very fact that scientific research has now, by universal consent, been made the business of the nation, might bring with it a new danger. The individual producing concern might become too trustful and be tempted to rely too much upon centralised sources of scientific information, and to confine its own investigations to *practical* problems affecting its particular business. The financial provision made for research in the industry of this and other countries was so divergent as to show that no agreed basis of calculation had yet been arrived at. The report of the Committee on Industry and Trade indicated that the capital invested in the general electrical industry of this country was about 121 millions sterling, and that the industry had only contributed about £50,000 to the Research Association in the five years ended 1926. It would be difficult to reconcile that fact with what was known of the excellence of British electrical equipment in the absence of a considerable amount of research by individual companies. Large companies in the United States expended annually on research sums ranging from 1 to 3 million dollars. Systematic research produced advantages far ahead of its cost. Talking recently with Dr. F. B. Jewett, of New York, about the modern universality of scientific research in the industry of the United States and the way in which it was rising to cater for the enormous *internal* demands of the country, he remarked that up to the present practically the whole effort was being made to provide for the needs of the home markets. Industry was facing *inwards*, he said, and he sometimes wondered what would happen to the rest of the industrial world when it found that, for continued life, it had to turn about, as it would some day, and face *outwards*.

NORTH-EASTERN STUDENTS' SECTION.—Friday, November 8th. Armstrong College. 7.15 p.m. "Controvisory Control of Power Stations." Mr. D. H. Leeson

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. J. L. WILLIAMS, late of Messrs. Thornton's, Wrexham, has been appointed assistant sales engineer to the Electricity Distribution of North Wales & District, Ltd.

Mr. E. S. EVANS, who has been district engineer of the North-East Coast Lighting Service Bureau since its inception in 1925, and during this year has been manager of the E.L.M.A. stand at the North-East Coast Exhibition, sailed last Friday for South Africa, to take charge of lighting development work in that country.

Last week Lieut.-Col. N. H. FIRMIN, O.B.E., T.D., was presented with a gold cigarette case by the chief officials of the Newcastle-upon-Tyne Electric Supply Co., Ltd., as a mark of their esteem on the occasion of his leaving the company's service to take up an appointment in London.

When the resignation of Mr. J. W. J. TOWNLEY, electrical engineer to the L.C.C. Tramways Department, was accepted by the London County Council in July last, the position was advertised at a commencing salary of £1,200, rising by annual increments of £50 to £1,500 a year, plus cost-of-living bonus, making the commencing salary £1,405 under present conditions. The Highways Committee now reports that 26 applications for the post were received. Five candidates were selected for interview, but one subsequently withdrew. As a result of the interviews the Committee records the opinion that the response to the advertisement was disappointing. In view of the nature of the position, the Committee considers that the salary offered should be increased to £1,700 per annum inclusive, rising by annual increments of £100 to £1,900. This would mean re-advertising the position, and it would be unlikely that it would be filled before January 1st, 1930.

The marriage took place at Biggleswade on October 31st of Mr. C. R. WESTLAKE, chief electrical engineer of Dumfries County Council for the Gretna and Durnock district, and Miss WINIFRED WESTERN, of Biggleswade.

On October 30th the Blackpool Town Council appointed Mr. W. M. CAMPBELL to the position of traffic superintendent at a commencing salary of £500 per annum.

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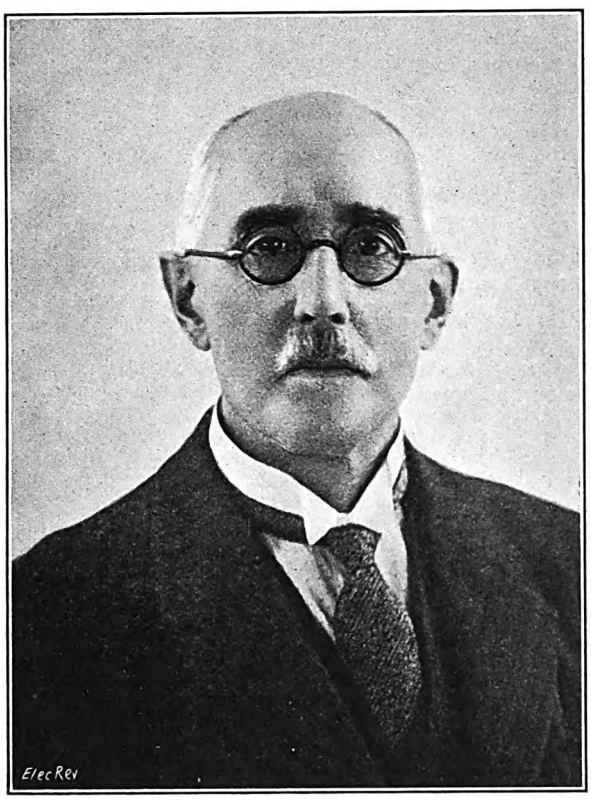
Mr. S. H. HOLDEN, M.I.E.E., who has retired after forty-one years' service with Chamberlain & Hookham, Ltd., was recently entertained by the directors of the company at a farewell dinner at the Grand Hotel, Birmingham, and presented with a cheque on behalf of the company, his colleagues having previously made a presentation. Mr. Holden is the author of many papers, and the originator of many inventions. In the early days he collaborated with the late Mr. George Hookham in the design and manufacture of the mercury motor ampere-hour meter, and in later years designed one of the first



Hudson Studios, Ltd.] *[Birmingham.*

Mr. S. H. Holden,

Who has retired after 41 years with Chamberlain and Hookham, Ltd.

alternating-current meters, and also the "Solar" electrolytic meter. Last year he was the chairman of the South Midland Section of the I.E.E., and had a very successful year of office. We hope, with his colleagues and friends, that he will have many happy years of retirement. Mr. Holden's portrait accompanies this note.

Mr. G. W. TURNER, A.M.I.E.E., has resigned his position on the staff of Messrs. Veritys, Ltd., and has now joined that of the English Electric Co., Ltd., 196, Deansgate, Manchester.

At a gathering of about 300 employés of the Plymouth municipal tramway and transport undertaking on October 27th, Mr. H. P. STOKES, who is resigning the position of engineer and general manager to take up a position with an omnibus concern, was presented with a canteen of silver and a gold wristlet watch, together with a dressing-table set for Mrs. Stokes.

Mr. T. DOUGLAS, assistant superintendent of telegraphs at the General Post Office, Cork, has retired on pension after a 44 years service. He was recently entertained at Desmond's Hotel, Cork, and at the function Mr. W. Cooper, postmaster, Cork, presided and made a presentation.

The Faculty of Medicine, University of Paris, has awarded the electro-radiological certificate to Mr. HAROLD H. U. CROSS, Ph.D., a former pupil of the General Electric Co., Ltd. Mr. Cross was the only English-speaking candidate in the 1929 examination. An American college has made a cable offer of its Chair of Electrotherapeutics, and it is understood that Mr. Cross will sail this month.

Mr. H. W. MILLATT, showroom manager to the Chester Electricity Department, has been appointed sales engineer to the Bedford Electricity Department at a commencing salary of £400 per annum.

Acting upon medical advice, Mr. W. HOLMES, electrical engineer to the Barking Urban District Council, recently tendered his resignation. The Electricity Committee accepted his resignation with regret, and appointed Mr. W. E. KIDNER, the present acting electrical engineer, as electrical engineer, at a salary of £725 per annum.

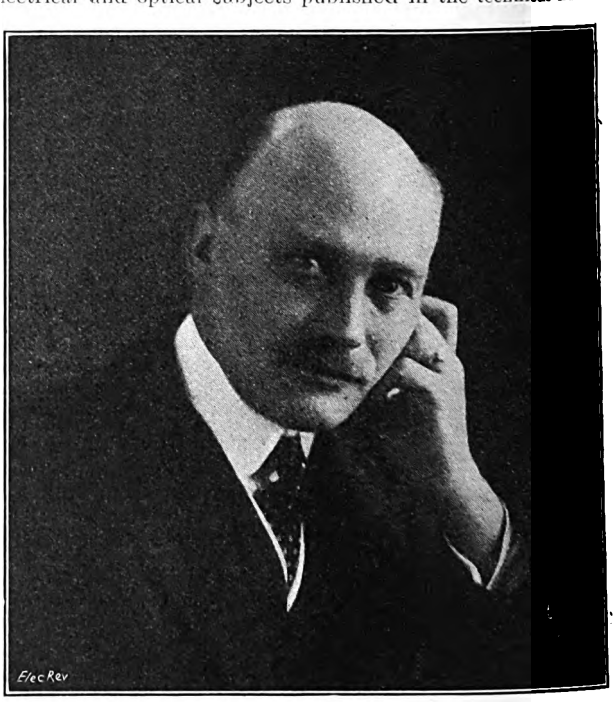
In the recent municipal elections Mr. W. G. PICKVANCE, of Pickvance, Ltd., Wrexham, who was formerly borough electrical engineer of that town, was elected a member of the Wrexham Town Council.

The Oldham Tramways Committee has appointed Mr. J. F. RICHARDS, rolling stock superintendent, general manager in succession to Mr. J. C. Jackson, who is taking up a similar position at Plymouth. The salary is £650, rising to £750 per annum. Mr. A. HEATHORN, chief clerk, has been appointed deputy manager.

Before departing last week to take up his new post at Felixstowe, Mr. A. J. WARING, borough electrical engineer of Newark, was presented by his fellow officials with a canteen of cutlery and set of carvers. The presentation was made by the Town Clerk (Col. H. Tallents, D.S.O.), who said that Mr. Waring's work at Newark in the short period of two and a half years had been a brilliant success. He took over a new undertaking which the Council thought might pay in five years, but in the second year it not only paid its way, but also actually showed a profit.

Bermondsey Borough Council Electricity Committee has promoted Mr. S. C. COWIE, switchboard attendant, to the position of engineer-in-charge, at a salary of £330 per annum.

We reported recently that Dr. C. V. DRYSDALE, O.B.E., M.I.E.E., &c., had been appointed Director of the Department of Scientific Research and Experiment at the Admiralty. Dr. Drysdale, whose portrait accompanies this note, was born in 1874; his father was senior physician to the Metropolitan Hospital and his mother was Dr. Alice Drysdale-Vickery. He was educated privately at the Finsbury Technical College and the Central Technical College. He earned several distinctions, having been the first Institute's Scholar at the Central Technical College and he gained the Siemens Memorial Medal, 1892, and diplomas in physics and electrical, mechanical and civil engineering. His doctorate in science was conferred in 1901 for a thesis on "The Behaviour of Iron and Steel in Rotating Magnetic Fields." He acted as confidential scientific assistant to Messrs. Nalder Bros. & Co., from 1893 to 1896, and then became associate head of the Electrical Engineering and Applied Physics Department of the Northampton Institute. In 1900 he was appointed head of the Optical Section. Dr. Drysdale was vice-chairman of the jury on optical instruments at the St. Louis Exhibition of 1904, and in the same year became president of the Optical Society. Since 1902 he has been examiner in optics to the Spectacle Makers' Company of which he is a liveryman. From 1910 to 1916 he was engaged privately in the study of economics and sociology, and from 1916 to 1919 he was partner in the firm of Messrs. H. Tinsley and Co. He joined the Admiralty in 1918 as chief of research at the Parkstone Quay experimental station; subsequently he was scientific director at the Shandon experimental station and superintendent of the Admiralty Research Laboratory, Teddington. Dr. Drysdale is the author of "The Foundations of Alternate-Current Theory" and "Electrical Measuring Instruments," and he has had a large number of papers on electrical and optical subjects published in the technical Press



Elliott & Fry] *[London.*

Dr. C. V. Drysdale, O.B.E., M.I.E.E., &c.,

Director, Department of Scientific Research and Experiment, Admiralty.

and the proceedings of scientific bodies. He is also a prolific inventor, having been responsible for many important developments in measuring and optical instruments, including the first accurate single-phase and polyphase wattmeters.

Obituary.—Mr. G. A. PEARSON.—The death occurred recently, at Halifax, of Mr. George Armstrong Pearson, M.I.E.E., electrical lecturer at the Halifax Technical College. He was 56 years of age.

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Mr. W. E. HELLIER.—We regret to hear from Venner Time Switches, Ltd., of the death, on November 3rd, of Mr. W. E. Hellier, their publicity manager, from pneumonia. Although Mr. Hellier had only been with the company for about two years, he had greatly endeared himself to all his colleagues, and his loss will be greatly felt.

Mr. G. P. COOPER.—We regret to learn that Mr. G. P. Cooper, of Messrs. Thompson & Cooper, engineers and merchants, Chancery Lane, W.C.2, passed away on November 1st after a long illness.

Wills.—The late Dr. RICHARD VERNON HANSFORD, a member of the research staff of the General Post Office, who was accidentally killed on October 5th, left estate valued at £3,674 (net personalty £2,396).

The late Mr. ARTHUR C. NEWSTEAD, who was a director of the Dowsing Radiant Heat Co., Ltd., left estate valued at £11,854 gross and £10,684 net personalty.

The late Mr. HERBERT LOUIS LEACH, consulting engineer, Victoria Street, S.W.1, left £23,481 (net personalty £23,199). Among a number of bequests he left £100 each to the I.E.E. Benevolent Fund and the I.E.E. Research Fund.

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Alfol Insulation, Ltd.—Private company. Registered October 31st. Capital, £1,000 in £1 shares. Objects: To acquire the business of dealers in an insulating material sold under a trade mark incorporating the word "Alfol" carried on at 3, Bramham Gardens, London, S.W.5, by N.V. Internationale Alfol Maatschappij, of Amsterdam, by its agent, L. G. Wilkening, and to adopt an agreement with the said company and Dr. E. Dyckerhoff. The subscribers (each with one share) are:—G. F. Shipman and C. E. Nisbet, 18, Austin Friars, E.C.2, solicitors. Solicitors: Slaughter & May, 18, Austin Friars, E.C.

Arrow (Preston), Ltd.—Private company. Registered October 31st. Capital, £100 in £1 shares. Objects: To carry on the business of electrical, wireless, telephone and telegraph engineers, manufacturers of electric lamps, valves, wireless apparatus, &c. The first directors are:—R. G. Wilson, 115, Duke Street, Birkenhead, shopkeeper; Marion E. Parsell, 10, Oarside Drive, Wallasey, Ches., manufacturers' agent. Secretary (*pro. tem.*): J. W. Hedley. Registered office: 17, Winckley Square, Preston.

Triumph Radio Co., Ltd.—Private company. Registered October 26th. Capital, £800 in £1 shares. Objects: To carry on the business of radio-telephony, and that of telegraph contractors, electrical engineering contractors, engineers, &c. The first directors are: L. O. Atkins, 76, Angell Road, S.W.9, radio engineer; S. C. Claydon, "Carrick Blacker," The Drive, Sevenoaks, radio engineer. Registered office: 223, Vauxhall Bridge Road, S.W.1.

D. F. M. Manufacturing, Ltd.—Private company. Registered in Edinburgh October 25th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electrical fuse wire, fuse-wire holders, &c. The directors are: J. Forrester, 106, Terregles Avenue, Pollokshields, Glasgow, physician; J. Miller, 46, St. Andrews Drive, Pollokshields, Glasgow, stockbroker. Secretary: J. Goold. Registered office: 7, Royal Bank Place, Glasgow.

Runbaken Motor & Electrical Accessories, Ltd.—Private company. Registered October 28th. Capital, £8,000 in £1 shares (4,000 ordinary, 1,500 "B," and 2,500 "C"). Objects: To acquire the business of makers, inventors, patentees and sellers of and dealers in motor and electrical accessories and commodities now carried on by J. H. Runbaken and S. W. Lewis at Tipping Street, Ardwick, Manchester, as "The Runbaken Magneto Co." The directors are: H. Burrows, 5, Veronica Road, Didsbury, Manchester; E. C. Arden, 41, Bentley Road, Liverpool; S. W. Lewis, 39, Victoria Street, S.W.1 (director, S. W. Lewis, Ltd.); J. H. Runbaken, Marydale, Hill Top, Wilmslow, Cheshire. Secretary: H. Burrows. Registered office: 30, Tipping Street, Ardwick, Manchester.

Veneeray Invisible Heating Co., Ltd.—Private company. Registered October 31st. Capital, £2,000 in 500 "A" and 1,500 "B" shares of £1 each. Objects: To acquire, use, exercise and vend certain inventions for manufacturing and installing heating apparatus for which a patent has been granted to F. H. Austen, and to carry on the business of heating engineers, electricians, mechanical and general engineers, &c. The permanent directors are:—F. H. Austen, chairman, 66, Carisbrooke Road, Leicester; E. C. Young, Roundhill Road, Leicester; Bertha E. Ramsay, Inversnaid, Wykeham Road, London. Solicitors: Ingram & Co., 8, Friar Lane, Leicester.

Dulrae Patents, Ltd.—Private company. Registered October 31st. Capital, £100 in 1s. shares. Objects: To acquire and turn to account any inventions, processes or apparatus relating to electric panel warming of buildings, and any other inventions, processes or apparatus relating to the warming, ventilation or cooling of buildings, to enter into two agreements, and to carry on the business of heating, ventilating and cooking and electrical engineers and contractors, electricians, &c. The first directors are:—J. L. Musgrave, "Rough Hey," Stoke Poges, Bucks. (director of Richard Crittall & Co., Ltd.); R. Grierson, "Kerrisdale," Bucks Avenue, Oxhey (director of Grierson, Ltd.). Registered office: 4, Bloomsbury Place, W.C.1.

Louth Electric Service, Ltd.—Private company. Registered October 28th. Capital, £500 in 100 10 per cent. "A" cumulative preference and 100 7½ per cent. "B" cumulative preference shares of £1 each and 600 ordinary shares of 10s. each. Objects: To carry on the business of electricians, electrical and mechanical engineers, manufacturers and workers of and dealers in electricity, &c. The provisional directors are: L. A. Gamlen, 136, West Street, Sheffield, and A. Shaw, 66-68, Brook Street, Hull, electrical engineers. Solicitors: Falkner, Son and Roberts, Louth, Lincs.

Official Returns of Electrical Companies.

Spensers (London), Ltd.—Capital, £12,000 in £1 shares. Return dated August 1st, 1929. 10,153 shares taken up. £2,153 paid, £8,000 considered as paid. Mortgages and charges: £1,000.

Croydon Cable Works, Ltd. (formerly Greenwich Cable Works, Ltd.),—Capital, £173,661 in 35,000 first preference, 25,000 second preference, 14,100 third preference, and 99,561 ordinary shares of £1 each. Return dated May 20th, 1929. 35,000 first preference, 25,000 second preference, 14,100 third preference, and 34,527 ordinary shares taken up. £35,000 paid, £73,627 considered as paid. Mortgages and charges, £65,000.

Tramways Syndicate, Ltd.—Capital, £2,500 in £1 shares. Return dated July 12th, 1929. 1,507 shares taken up. £7 paid, £1,500 considered as paid. Mortgages and charges, nil.

Chepstow Electric Lighting & Power Co., Ltd.—Capital, £10,000 in £1 shares. Return dated May 30th, 1929. 5,510 shares taken up. £1,605 paid, £3,905 considered as paid. Mortgages and charges: £1,000.

British Mica Co., Ltd.—Capital, £5,000 in 2,000 preference and 3,000 ordinary shares of £1 each. Return dated June 6th, 1929. 885 preference and 2,194 ordinary shares taken up. £1,079 paid on 885 preference and 194 ordinary shares, £2,000 considered as paid on 2,000 ordinary shares. Mortgages and charges: £2,300 debentures and £650 mortgage.

F, B. Hellon & Co., Ltd.—Capital, £4,000 in £1 shares. Return dated July 2nd, 1929. 3,000 shares taken up. £3,000 paid. Mortgages and charges, nil.

Mansfield & District Tramways, Ltd.—Capital, £180,000 in 80,000 6 per cent. cum. preference and 100,000 ordinary shares of £1 each. Return dated May 10th, 1928. 80,000 preference and 44,834 ordinary shares taken up. £80,609 paid on 62,767 preference and 17,842 ordinary shares, £44,225 considered as paid on 17,233 preference and 26,992 ordinary shares. Mortgages and charges: £82,311.

British B.A.G., Ltd.—Capital, £12,000 in £1 shares. Return dated June 17th, 1929. All shares taken up. £9,000 paid, £3,000 considered as paid. Mortgages and charges, nil.

Welwyn Garden City Electricity Supply Co., Ltd.—Capital, £50,000 in 47,000 preference shares of £1 each and 60,000 ordinary shares of 1s. each. Return dated June 27th, 1929. 25,903 preference and 60,000 ordinary shares taken up. £28,903 paid. Mortgages and charges: £40,000.

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Cox-Cavendish Electrical Co. (1924), Ltd.—Capital, £6,000 in £1 shares. Return dated August 16th, 1929. 4,344 shares taken up. £4,344 paid. Mortgages and charges, nil.

Saunders Electrical Co., Ltd.—R. B. Leech, 23, Warwick Row, Coventry, ceased to act as receiver or manager on September 3rd, 1929.

British General Radio Co., Ltd.—Satisfaction to the extent of £100 on September 29th, 1929, of debentures authorised by resolution dated March 8th, 1924, securing £1,000.

Banbury and District Electric Supply Co., Ltd.—Capital, £50,000 in £10 shares. Return dated August 6th, 1929. All shares taken up. £25,000 paid. £25,000 considered as paid. Mortgages and charges at date of return, nil.

Eckington Electric Supply Co., Ltd.—Capital, £5,000 in £1 shares. Return dated May 28th, 1929. All shares taken up. £5,000 paid. Mortgages and charges, nil.

Nox Electric Lamp Co., Ltd.—Capital, £15,000 in £1 shares. Return dated August 15th, 1929. All shares taken up. £14,500 paid. £500 considered as paid. Mortgages and charges, £12,200.

Llangollen and District Electric Light and Power Co., Ltd.—Capital, £6,000 in 2,500 preference and 3,500 ordinary shares of £1 each. Return dated July 19th, 1929. 360 preference and 1,754 ordinary shares taken up. £2,113 5s. paid, leaving 15s. in arrears. Mortgages and charges at date of return, £2,900 (£300 since paid off).

Yorkshire (Woollen District) Electric Tramways, Ltd.—Capital, £500,000 in 250,000 preference and 250,000 ordinary shares of £1 each. Return dated May 9th, 1929. 220,000 ordinary shares taken up. £220,000 paid. Mortgages and charges, £34,800 issued to bankers as collateral security.

Potteries Electric Traction Co., Ltd.—Capital, £600,000 in 300,000 preference and 300,000 ordinary shares of £1 each. Return dated June 14th, 1929. 245,000 preference and 245,000 ordinary shares taken up. £423,340 paid on 245,000 preference and 178,340 ordinary shares. £66,660 considered as paid on 66,660 ordinary shares. Mortgages and charges, £246,389 9s.

John Davis & Son (Derby), Ltd.—Capital, £35,000 in 15,000 preference and 20,000 ordinary shares of £1 each. Return dated July 10th, 1929. 11,000 preference and 15,000 ordinary shares taken up. £26,000 paid. Mortgages and charges, nil.

Union Cable Co., Ltd.—Capital, £100,000 in £1 shares. Return dated May 23rd, 1929. All shares taken up. £75,000 paid (being £1 per share on 50,000 and 10s. per share on 50,000 shares). Mortgages and charges, nil.

Bayntons Wholesale Wireless, Ltd.—Capital, £2,500 in £1 shares. Return dated April 15th, 1929. 2,500 shares taken up. £2 paid. £2,498 considered as paid. Mortgages and charges, nil.

Fitt Bros. & Davies (1924), Ltd.—Capital, £6,000 in £1 shares. Return dated July 16th, 1929. 3,596 shares taken up. £3,596 paid. Mortgages and charges, £2,000.

City Notes.

Drake & Gorham, Ltd.

The annual meeting of this company was held on October 29th, Mr. B. M. Drake (chairman) presiding. After referring with regret to the death of Mr. Gorham, the chairman said that it was satisfactory that they were able to maintain the same rate of dividend as for the previous three years, and to continue placing a substantial sum to general reserve, thereby increasing the book value of the proprietors' shareholdings. Whilst necessarily affecting the sale of private house generating plants, the spread of supply mains was opening up new fields for their activities. The Bank of England contract had been temporarily held up, owing to the large amount of excavation which had to be carried out in preparation for the second section of the rebuilding, but it was hoped that it would be possible to proceed with the electrical equipment during the current financial period. The new broadcasting station at Brookman's Park was the first of its type, and they had secured the contract for the power wiring between the various generating sets, switchboards, auxiliaries and transmitter units. They also erected the two 12,000-V transmission lines from the transmitter hall to the aerials. In addition to the power work they were responsible for the electric lighting of the station. The electric sign department continued to expand, and the value of an agency which they held for the north-western district appeared to be increasing. Referring to the successful results obtained with h.p. "Metesco" switchgear, to which he had referred at the previous meeting, the chairman said that since then they had developed a new ring main controller, and had applied for patents. This had been most favourably received by supply companies; in fact, the demand for all their specialities, including main switchboards, had increased to such an extent that the problem of providing new works must be faced without delay if they were to keep pace with the orders. They had had a number of inquiries from overseas, but must build or acquire larger works before extending sales abroad. The department which dealt with "Duro" pumps and water softeners had made great progress.

Atlas Light and Power Co., Ltd.

The annual meeting was held on October 30th. Mr. W. Sandford Poole (chairman), who presided, said in the course of his speech that they regretted that Sir George Touche had been compelled to resign the chairmanship on account of ill-health, but he would still be a director. They had received a total of £8,878,000 from the sale of their Argentine interests, including £378,000 in respect of interest and other credits for revenue account. They still owned the entire stock of the two tramway companies operating in Montevideo; these concerns had now been combined, but they had not yet obtained full liberty from the local authorities to run them as one concern. The tramways had suffered severely from omnibus competition, and the restrictive conditions precluded the companies from introducing motor-'bus services. Substantial economies had been made, and the services had been improved with the result that during the first half of the year the traffics had improved. Considerable expenditure would have to be incurred for a time with a view to conserving the position in Montevideo. Out of the sum realised from the sale of the Argentine investments, £1,500,000 had been applied as a provisional reserve against the remaining investments. After referring to the conversion of the debenture issues, the chairman said that on considering the investment of the substantial sum available, they felt that there was grave danger in the pace at which prices of common stocks in American companies were being advanced. They had decided not to take up their option to call for an allotment at $100 of any part of the 100,000 preference shares of the South American Power Co. At present, therefore, they retained a large part of their funds in the form of Treasury Bills and bank deposits. Of their 208 general investments, the largest single investment was just over £50,000 and the average £11,200. Owing to the fact that the company was now an investment trust company, it was proposed to change its name to "Atlas Electric and General Trust, Ltd" The report and accounts (*vide* our last issue, p. 770) were adopted, and the change of name was approved.

Hydro-Thermal Power, Ltd.

Brig.-General E. L. Spears, C.B., M.C. (chairman), presiding at the statutory meeting on October 30th, said that the company owned the world's patent rights of an invention calculated to put a new value on water power. Briefly, they claimed that the company's system provided a means of utilising water power resources with an important saving in capital and working costs. It was applicable to numerous hydro-electric schemes at present under construction, as well as others whose conditions had hitherto been adjudged uneconomical. It also for the first time made practicable the commercial utilisation of intermittent and fluctuating sources of hydraulic power, such as the rise and fall of tides. With a view to demonstrating the practicability and commercial utility of the system, it was decided to install a unit at Avonmouth Docks to operate under actual tidal conditions, and that unit would be in operation within three or four months. The firms engaged upon the manufacture of the plant for this demonstration were Messrs. Heenan & Froude, Ltd., in conjunction with the English Electric Co., Ltd., Ruths Steam Storage, Ltd., and Boving & Co., Ltd.

Telephone Manufacturing Co., Ltd.

At the last annual meeting it was stated that, although the installation side of this company's business showed a profit, the loss on the manufacturing side continued owing to unremunerative prices. It was therefore proposed to segregate the two parts of the business, and the scheme for this purpose has now been forumulated and will be presented to the shareholders on November 25th at an extraordinary general meeting. The scheme provides for the voluntary liquidation of the existing company and the formation of two new companies. The first will be known as Telephone Rentals, Ltd., and will have a capital of £600,000 in 5s. shares. It will act as a holding concern for the 17 subsidiaries which install telephone instruments, &c., on a rental basis. The business of manufacturing apparatus for the installation companies, the General Post Office, &c., will be in the hands of the Telephone Manufacturing Co. (1929), Ltd., which will have a capital of £250,000 in 5s. shares. The existing company's capital amounts to £1,000,000 in 10s. shares, and it is proposed that for each two shares the holders shall receive one share in each of the new companies. It is hoped that the reorganisation will place the manufacturing company upon a profit-earning basis.

Marco Refrigerators (1929), Ltd.

Presiding at the statutory meeting on October 30th, Sir Sven Hansen, Bt. (chairman) said that since the company started trading the sales had increased by 50 per cent. over those of the corresponding period of last year. Many agencies had been opened up, including important firms and electricity supply companies. Among the recent developments were an all-metal domestic refrigerator and large commercial equipments. They looked forward with confidence to a successful year's trading and to progressive expansion.

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British Columbia Power Corporation, Ltd.

The first annual report of this company, which took over the British Columbia Electric Railway Co., Ltd., records a gross revenue of $14,681,263 for the year ended June 30th last. The net revenue amounted to $4,616,396. From this is deducted interest, &c. ($2,632,981) and dividends on Class A shares ($2,000,000), leaving a balance of $837,763. This is added to the existing surplus, and the whole amount ($66,203,528) is carried forward. During the year the capital expenditure was $4,612,252. It was decided to proceed with the first stage of the Ruskin power development, which involves an ultimate expenditure of over $20,000,000. The potential capacity of the development is 188,000 h.p., and the first stage will consist of the installation of a 47,000-h.p. plant by October last year. The sales of electricity during the year rose from 290,405,805 kWh to 342,647,810 kWh. A centrally-located showroom, costing over $600,000, was opened in Vancouver last December; it is said to be the most modern and completely-equipped building of its kind in Canada. The annual meeting was held on October 31st.

Cia. Hispano-Americana de Electricidad.

This company (known as the "Chade") announces the acquisition of an interest in the Primitiva Gas Co. of Buenos Aires, and states that the services of the two companies are to be co-ordinated. It has also obtained control of the Cie. d'Electricité de la Province de Buenos Aires, which supplies electricity in the suburbs of the city. Interests in other electrical and gas concerns have been acquired.

Erinoid, Ltd.

The directors report that the trading profit for the year ended August 31st was £24,549, as compared with £28,648 in 1927-28. The net profit fell from £21,268 to £18,213. With the balance brought forward and payments received from the French and American companies, there is an available balance of £25,648. The final dividend is 4½ per cent., again making 7 per cent. for the year; £5,000 is placed to general reserve, and £250 to staff fund, leaving £5,113 to be carried forward.

Stock Exchange Notices.

The undermentioned have been ordered to be officially quoted:—

London Power Company.—£3,000,000 five per cent. debenture stock.

Underground Electric Railways Company of London.—4,292 ordinary shares of £1 each, fully paid, Nos. 7,249,692 to 7,253,983.

Official Notice *re* Companies.

The names of the undermentioned companies will be struck off the list at the expiration of three months unless cause is shown to the contrary:—

Electrification, Ltd.
Laing Wharton, Ltd.
Northern Radio & Electrical Factors, Ltd.

National Telewriter Co., Ltd.

Out of a net profit of £1,190 (against £1,254) and the amount brought forward, it is proposed to pay a dividend of 2d. per share on the preferred ordinary shares.

W. T. Henley's Telegraph Works Co., Ltd.

The directors have declared an interim dividend on the ordinary shares of 1s. 6d. per share, less tax, to be paid on December 2nd.

Hydro-Electric Securities Corporation.

A quarterly dividend of $0.50 per share has been declared on the common stock.

Oxford Electric Co., Ltd.

The directors have declared an interim dividend at the rate of 7 per cent. per annum on the ordinary shares, as last year.

Anchor Cable Co., Ltd.

The interim dividend is again 5 per cent. actual (less tax).

German Companies.

The *Rheydt Cable Works Co.* has declared a dividend at the rate of 12 per cent. for 1928-29, as in the previous year. At the general meeting the general director is reported to have stated that the directors would perhaps have again to produce abroad, as the German market was too narrow and the export possibilities were hampered by high wages and high taxes. It was not yet known whether the company's means would be sufficient for the purpose or when, where, and how this development would be effected.

The *Electricity Co.* (late *W. Lahmeyer & Co.*), Frankfort-on-Main, states that last year the sales of the supply undertakings connected with the company increased by from 16 to 17 per cent., while the traffic undertakings exhibited a smaller improvement. The constructional departments were well occupied, and still had an abundance of orders on hand. The net profits amounted to 2,440,000 marks, as against 2,032,000 marks in 1927-28, and the dividend is raised from 10 per cent. to 12 per cent.

Stocks and Shares.

TUESDAY EVENING.

THE Stock Exchange markets have recovered to a considerable extent from the shock of the great collapse in American stocks and shares which occurred about a week ago. Prices have swung backwards and forwards in astonishing fashion. The investment markets, however, are sadly subdued by the Government's proposal to offer a new 5 per cent. Conversion Loan at 100. The immediate effect was to cause heavy falls in the prices of British Government securities, and to upset the calculations of investors who had looked upon 4¾ per cent. as a criterion of yield against which other stocks and shares could be measured. If there is to be a 5 per cent. stock on tap at 100, this will imply that other gilt-edged securities must come sooner or later into line with the new issue. For this reason, a number of falls have occurred already in gilt-edged securities, both in the Government list, as already mentioned, and in that for Home Railway prior-charge stocks. Industrial debentures, preference shares and the like cannot escape from the mal-influence imposed by a new form of borrowing which, on the face of it, looks extravagant in its inception and its terms.

Home Rails and Trams.

The Home Railway market is quiet, and, except for the gilt-edged stocks, the tendency is steady. Underground income bonds remain at 105, and the shares are a little better at 22s. 6d. Metropolitan consolidated shaded off to 61, otherwise the group is steady. The falls amongst the prior-charge issues ranged from ¼ to 2 points. Some of the declines are precautionary, and are due to sympathy with the prevailing tendency elsewhere, rather than to any pressure to sell. It is improbable that there will be any stock worth mentioning coming to market in this section as a result of the new Government issue. The effect will be felt, however, in the restraint laid upon employment of fresh money, which otherwise might have come into the market in view of the fall last week in the Bank Rate to 6 per cent., and the hope, so soon to be quenched, of gilt-edged stocks advancing in capital value.

Metropolitan Electric Tramways 4½ per cent. debenture stock has strengthened to 74, and the company's 5 per cent. debenture rose to 70½. Apart from these movements, the tramways group is unchanged. A fall of 125 points in British Electric Traction deferred stock looks spectacular, but has no special significance.

Cables and Wireless.

Cables & Wireless "B" ordinary, which stood at 50 in our last week's issue, fell to 40 a few days later. The price recovered 7 points on the day following this slump, and rose further to 50½. The "A" ordinary stock, at 82, is ½ higher, and the 5½ per cent. preference further strengthened to 97½. The gyrations in the "B" stock were due to the changing hands of comparatively small amounts of stock. No doubt a certain quantity of this came from the other side of the Atlantic, where, it will be remembered, Americans bought a fair amount when the stock was issued last July. Americans have been obliged to sell anything that was saleable; hence the severity of the collapse in the price. Directly the selling orders were withdrawn, the price rebounded like a rubber ball—though the simile is perhaps not altogether a happy one if pressed back to the raw rubber itself, the price of the latter having fallen below 8½d. per lb. by reason of the fear that the slump in Americans will bring about a considerable diminution in the demand for motor cars in the States.

New York Telephone 4½ per cent. bonds have receded to 96½. Amazon Telegraphs are £1 lower at 30s. A rise of 1/16 lifted Marconi Marines to 2 3/16 on the hope that ocean telephony is on the point of becoming commercially practicable. Canadian Marconis are 20s., and Burndepts 3s. 3d.

Dollar Stocks.

Hydro-Electrics, which were 72 three weeks ago, have been down to 41 during the past few days, but on the New York recovery the price rose to 53½, relapsing later to 47½. The company has doubled its previous quarterly dividend of 25 cents. Montreal Light, Heat & Power fell 35 to 127½, and then recovered to 150, which leaves the price 12½ down on the week. Pennsylvanias, at 90, have not changed. Power Corporation of Canada, at 90½, are 7 lower, following upon their drop of 15 last week. Mexican Light & Power common recovered to 90, which is a gain of 5 points; though, on the other hand, Mexico Tramway shares, at 43½, show a fall of 3. Brazilian Tractions dropped back to 48½, a fall of 4½. Electrical Development of Ontario fives are easier at 95½. Shawinigan Water, at 87½, are 3½ better. Canadian Generals are 410, and Calgary Power shares 175. American Telephone and Telegraph shares, which came down 70 points in a fortnight, have recovered 5 to 245, and International Telephone and Telegraph are unchanged at 90. Anglo-Portuguese Telephones are steady at 21s. 3d., Constantinople Telephones keep at about 3.

Employment and Electrification.

The Government's plan for providing work, the outline of which was presented by Mr. J. H. Thomas in the House

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of Commons last Monday, is expected to prove advantageous to a number of companies engaged in electrical work. He mentioned the schemes of the Duckham Committee, one involving an expenditure of seven million pounds by the Great Western, London Midland & Scottish and Metropolitan Railways, while the 13 million pound programme of the Underground Electric Railways means the distribution of substantial contracts to a number of companies dealing with electrical work. The London Midland & Scottish is spending a lot of money in electrification, and there is, of course, the constant outlay by the Central Board, whereby the country is becoming covered with a network of electric cables. It is usually held in the Stock Exchange that Government contracts do not necessarily provide any very remunerative work, but they serve to keep the wheels running in a manner which enables other contracts to be accepted at more paying rates. The manufacturing companies stand, therefore, to benefit by the new programme of schemes for providing employment, and the market for shares in electrical manufacturing companies is, generally speaking, steady, although there are a few declines after the material rises that had taken place.

The Manufacturing Companies.

Brush ordinary stock has fallen 3½ points to 126½, and has been a consistently bad market ever since the time when the shape of the capital was altered, from shares of £1 each, to stock. Rumour toyed some time ago with the idea that the Brush Company was amongst those in which the Americans were desirous of acquiring a considerable interest, linking its name with those of the General Electric Co., Ltd., and the Associated Electrical Industries as a company which the Americans foresaw might be of considerable value in the extension of schemes with which they—the Americans—were credited. No evidence has been forthcoming, however, of any noticeable demand from the United States for Brush stock. British Insulated ordinary have gone back to 3⅞, though there has been a good deal of buying of the shares in the neighbourhood of 78s. 9d. The yield on the money at the present price is under 4 per cent. The impression is general that the British Insulated is not likely to increase its dividend from the present-paid 15 per cent., but that the time is near at hand when a further issue of new shares is likely to be made, either by way of bonus, or on terms that will give the proprietors a handsome present. The company is known to be doing well, and, according to rumour, possesses large hidden reserves. Enfield Cables are a little easier at 4¾. Associated Electrical ordinary recovered to 33s. 9d., and General Electrics to 2 7/16, in the improvement which occurred after the Wall Street panic, and, although a number of the American industrials fell back again on profit-taking sales, the electrical shares held their ground. Henley's have declared a dividend of 1s. 6d. per share, less tax, on the ordinary, payable on December 2nd, this being the same rate as that of a year ago. The shares are somewhat easier at 6¼. British Power & Light continue dull at 14s.

Electricity Supply Shares.

Amongst the electricity supply companies' shares, Clyde Valleys fell back ⅛ to 38s. 9d., for want of confirmation of the report that the Americans intend to take over the company at a price which will give the shares about 60s. Having regard to the financial conditions which prevail in America as a direct result of the slump, it is natural that a good many hopes which have been founded upon the anticipation of American enterprise becoming still more energetic in Great Britain must be relinquished. Some of the schemes are probably only postponed. Midland Counties, which also had been considered one of the companies upon which would-be American control cast envious eyes, have gone back 3s. to 30s. Scottish power lost a few pence at 30s. Yorkshires are 1s. down at 34s., and Urban Ordinary fell 1/16 to 37s. Metropolitan Electric ordinary shares, after their rise to 47s. 6d. on the expectation of a new issue being made on bonus terms, reacted to 46s. 3d. The meeting to pass the necessary resolutions for increasing the Metropolitan Electric capital was held in the Wednesday of this week, and, the secret of the new issue having been extremely well preserved, no inkling of its nature has leaked out up to the time that this is being written, on Tuesday night. North Metropolitans, after being 54s., reacted to 52s.

Miscellaneous Matters.

The tendency amongst provincial electrical shares is somewhat easier, and, in the foreign group, Perak Hydro-Electrics fell back to 13s. 6d., the debenture to 106½. The Indian group is dull by reason of the uncertainties that have arisen over what is called the political crisis, nor is there any recovery amongst the shares in the Australian companies, the prices of which were somewhat depressed owing to the return to power of the Labour Party in the Commonwealth. Atlas Light and Power strengthened to 28s. Burma Electric Supply ordinary have gone back to 15s. La Plata Tramways preference are lower at 1. Amongst the few rises on the week may be mentioned a small gain in Vera Cruz Light, Power, and Traction, the price hardening to 64½. A better tendency in the Iron and Steel market led to an advance of 9d. in Babcock & Wilcox. Vickers at 8s. 4½d. show a slight improvement.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Approx. Dividend. 1927.	1928.	Price Nov. 5 1929.	Rise or fall	Yield p.c.
Bournemouth and Poole	1	15	15	62/-	—	4 16 9
Brompton Ordinary	1	8½	8½	26/-	—	5 7 8
Charing Cross Ordinary ...	1	8½	8½	26/6	—	5 5 8
do. do. 4½% Pref. ...	1	4½	4½	17/-	—	5 6 0
Chelsea	1	8¼	8¼	25/-	—	5 12 0
City of London	1	10	10	32/-	—	4 7 6
do. do. 6% Pref....	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	1 1/16	—⅛	... ...
County of London	1	7	10	51/6	—1/-	3 18 0
do. do. 6% Pref....	1	6	6	22/6	—	5 6 8
Edmundson's 7% Pref. ...	1	7	7	24/-	—	5 16 8
Elec. Supply Corporation ...	1	11	11	52/-	—	4 4 8
Kensington Ordinary ...	1	8	8	26/-	—	5 7 8
Lancs. Light and Power ...	1	7½	7½	28/-	—	5 7 2
London Electric	1	8½	9	27/6	—	5 1 10
Metropolitan	1	9	9	46/3	—1/-	3 18 0
do. 4½% Pref. ...	1	4½	4½	17/-	—	5 6 0
Midland Counties	1	6½	6½	30/-	—3/-	4 6 8
Mid. Elec. Power	1	15	8	34/6	—	4 12 9
Newcastle-on-Tyne Ordinary	1	6	6	26/3	—	4 11 5
do. 7% Pref. ...	1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref. ...	10	6	6	11	—	5 9 1
North Met. Elec. 6% Pref. ...	1	6	6	21/6	—	5 11 8
St. James' and Pall Mall ...	1	8	8	26/6	—	5 5 8
Scottish Power	1	8	8	30/-	—6d.	5 6 8
South London	1	8½	8½	26/6	—	5 5 8
Urban Ordinary	1	7	7	37/-	—1/16	3 15 8
Westminster Ordinary ...	1	8½	8½	25/6	—	5 9 10
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	23/6	—	6 7 8
Yorkshire Elec.	1	8	8	34/-	—1/-	4 14 2

Home Rails.

Central London Ord. Assented ...	Stock	4	4	71	—	5 12 8
Metropolitan	,	8	8½	61	—½	5 14 10
do. District	,,	4	5	73	—	6 17 0
Underground Electric	£1	5	7	22/6	+6d.	6 4 8
do. do. Income ...	Bonds	6	6	105	—	5 14 8

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	98½	—	5 1 10
do. Def.	,,	1½	1½	24¾	—	6 4 6
Automatic Telephone	1	10	12½	37/6	—	6 13 4
Cables & Wireless 5½ Pref.	Stock	—	—	97½	+½	5 12 10
do. A 7½ Ord.	,,	—	—	82½	+½	... ...
do. B Ord.	,,	—	—	50½	+½	... ...
Globe Tel. and T. Ord.	10	10	10	29¼	—	*4 6 1
do. do. Pref.	10	6	6	10⅝	—	5 9 1
Great Northern Tel.	10	20	17½	29	—½	6 0 9
Indo-European	25	10	10	47½	—	*5 5 8
Marconi-Marine	1	12½	15	2 1/16	+1/16	... ...
Oriental Telephone Ord	1	12	12	2 15/16	—	... ...

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	8 1/16	—	8 19 6
do. do. 2nd Pref. ...	5	6	6	8 1/16	—	9 16 0
do. do. 5% Deb. ...	Stock	5	5	75	—	6 13 4
British Electric Traction Def. Ord.	,,	5	5	1475	—125	... ...
do. do. Pref. Ord.	,,	8	8	124½	—	6 8 6
Brazil Traction	100	7	8	48½	—½	4 2 6
Brit. Columbia Elec. Rly. Pcc. ...	Stock	5	5	86½	—	5 15 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	9/6	—	... ...
London United Tram Deb. ...	Stock	4	4	51½	—	7 15 4
Mexico Trams, 5% Bonds ...	—	5	5	72½	—	6 18 0
Mexican Light Common	100	Nil	Nil	90	+5	... ...
do. 7% Pref.	100	7	7	77½	—	9 0 6
do. 1st Bonds	—	5	5	77½	—	6 9 0
Yorkshire (West Riding)		Nil	Nil	5/-	—	... ...

Manufacturing Companies.

Assoc. Elec. Ord.	1	6	—	33/9	+⅛	3 11 0
Babcock & Wilcox	1	18	15	3 1/16	+9d.	*4 18 0
British Aluminium Ord.	1	10	10	47/6	—	*4 4 5
British Elec. Transformer Pref. ...	1	7	7	13/-	—	... ...
British Insulated Ord.	1	15	15	3⅞	—⅛	3 17 4
Brush Ord.	Stock	10	10	126½	—3½	7 18 1
Callenders	1	15	15	3¼	—¼	4 0 0
do. 6½% Pref.	1	6½	6½	1¼	—	5 4 0
Crompton Parkinson Ord.	5/-	—	30	20/6	—9d.	7 6 6
do. 8% Pref.	1	8	8	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	7 1 2
do. 5% Deb.	Stock	5	5	84½	—	5 18 4
Electric Construction	1	7½	5½	15/-	—	7 6 8
Enfield Cable Ord.	1	20	20	4¾	—	4 2 0
English Electric	1	Nil	Nil	7/6	—	... ...
do. do. Pref.	1	8	Nil	8/9	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
do. Ord.	1	10	10	2 7/16	+⅛	4 2 0
Henley...	1	25	30	6¼	—⅛	4 16 1
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	Nil	Nil	11/3	—	... ...
Johnson & Phillips	1	10	—	2	—	5 0 0
Siemens Ord.	1	7½	7½	27/6	—	5 9 1
Telegraph Construction	12	10	10	23	—	5 4 2

*Dividends paid free of Income Tax.

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Merchandise Marks.—I.

A Brief Survey of the Scope of the 1887 and 1926 Acts.

By W. ERIC JACKSON, LL.B., Barrister-at-Law.

THE Merchandise Marks Acts (of which there are several) during the period of office of the last Government, came into prominence in connection with the general desire to stimulate Empire trade, and to safeguard British industries. The marking of foreign and British goods with the country of origin was one method of ensuring that the public knew when it was purchasing foreign goods. The attitude of the present Government although opposed to the principle of safeguarding seems to be none the less in favour of stimulating British and Empire trade, and it may therefore be assumed that the Merchandise Marks legislation will not be altered for some time.

The Act of 1887, which was the principal Act on this matter, was passed to deal with trade descriptions of all kinds, and it was intended to prevent fraud on the public. Roughly, it created three offences, namely, the forging of a trade mark, the false application of a trade mark, and the false application of a trade description. The first class needs no explanation. Obviously to forge the trade mark of another is an offence which should be suppressed. The second class of offence, to " apply " a false trade mark is a somewhat similar offence. To put one's own goods into the box or wrapper of another manufacturer may not be forgery, but it is certainly a false use of the mark and is an offence.

The third-class, to apply a false trade description, applies to almost anything. To sell as an " English lever watch " an article which has merely been assembled here from parts made abroad has been held to be an offence of this kind. A " trade description " means any indication as to number or quantity, or mode of manufacture, material, or place of manufacture.

It will be seen that the Act does not compel sellers of goods to mark their goods at all. But if they do, the description must be true. This Act of 1887 has been used to prosecute sellers of artificial silk for selling the material as real silk, and it has been used to prevent the sale of wine as " port " unless it comes from Oporto. It will be noticed that indication of origin is only one of the points covered by the Act. The Act of 1887 is still in existence and is still used for preventing the sale of articles which come within the cases mentioned above. The seller can defend himself if he can show that he took all reasonable precautions against fraud, had no cause to suspect the genuineness of the mark, and, in addition, gave all the information he could to the police to enable the right offender to be caught. The penalties under the Act are heavy. On first conviction before a magistrate a fine of up to £20 may be imposed, or imprisonment up to four months. On a second conviction the fine may be raised to £50 and the imprisonment to six months. If the offence is very serious the offender may at the first instance be sent to be tried at Assizes and be fined up to any amount with imprisonment up to two years.

Now the Act of 1926, which is the important Act of to-day, and concerning which so much discussion has taken place, deals only with the question of marking goods with the country of origin. There are two classes of goods which come within the Act. First, there are those goods which bear the name or trade mark of a British manufacturer, or trader, and secondly, there are those which do not bear such a mark. Familiar examples may be remembered from the Parliamentary discussions on the subject. Dairy produce, raw materials such as leather, glass and paper, as well as finished articles come within this second class, all so long as they do not bear the mark or name of a British trader.

It is convenient to deal with these two classes separately. Both classes, of course, include only imported goods. Goods made here do not require to be marked. As to the first class, the Act says that " imported goods bearing the name or trade mark of a British manufacturer or trader are not to be sold unless accompanied by an indication of origin." The Board of Trade has power to exempt goods in certain cases. The wording of the Act is very specific. " It shall not be lawful to sell, expose for sale, or, by way of advertising some other goods, distribute " any imported goods unless the name or trade mark is accompanied by an indication of origin.

" Sale " includes wholesale as well as retail sales, but it does not include a sale of goods by consignment to a person outside the United Kingdom, nor does it apply to sales of second-hand goods. The Act does not refer to purchases, hence the responsibility is always with the seller. A customer who buys from a retailer is not bound to trouble about the mark. And similarly a retailer who buys from a wholesaler is not obliged to bother about the mark unless and until he exposes the goods for sale or becomes himself a seller. It is not an offence to have goods in one's possession unmarked, and so far as wholesalers only are concerned it is not an offence to expose them for sale unmarked.

Thus from all this we deduce the following results. To buy from a foreign seller, and re-sell them to another buyer abroad is no offence if the goods are unmarked. The wholesaler is just as much bound to mark the goods as anyone, and if a retailer receives a consignment of goods unmarked, he is entitled to raise the question and if necessary reject them; for the sale of goods unmarked, when they should be marked, is illegal. The retailer may agree to receive them in an unmarked condition and do the marking himself. In that case, although a private agreement cannot remit the wholesaler's liability, the retailer will himself become bound to mark them and will be liable if he exposes them for sale without marking.

It remains to consider what goods must be marked. Such are " imported goods to which is applied the name or trade mark, being or purporting to be, the name or trade mark of any manufacturer, dealer or trader, or the name of any place or district in the United Kingdom." All of which simply means goods bearing a British name or place. Thus cigarettes bearing a British firm's name must have " Virginia " on them, or other words indicating their origin. On a similar principle an article such as " Newcastle cables," or a product going by the name of the " Bristol battery " would have to bear an indication of origin.

To " apply " the name or mark to goods means putting the name on the goods themselves or on the label, covering, reel, or other thing in or with which the goods are sold or exposed. It would appear that each article should bear the mark, each lamp in the box if the lamps are sold separately, each piece in a set. And if the goods are sold in combination with other goods, such as in the case of a British pocket lamp with a foreign battery, each article should be separately marked. If the articles are sold wrapped up in sealed cartons or in specially printed wrappers which are not taken off when the goods are sold, the marking of the wrapper will be enough. But if the goods such as pencils in a box, are sold without being individually marked, this will be an offence, even though the box is marked.

The 1926 Act deals only with indicating the country of origin. Any fraud or false marking is dealt with under the Act of 1887. The 1926 Act provides its own penalties and its own exemptions and raises a number of quite different points.

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The Rationalisation of Industry.

A review of a lecture delivered at a recent meeting of the Rugby Engineering Society by Mr. A. P. Young, of the British Thomson-Houston Co., Ltd.

THROUGHOUT the ages progress has meant work and gradually it has come to mean work by machines. The potentialities of production by machinery have necessitated the study of rationalisation. To understand the problem it is necessary to have an idea of the evolution of the industrial era. Until the eleventh century craftsmanship was individual and unorganised; it was then that the craftsmen began to form groups or guilds, thus establishing definite industries. By the 14th century certain industries had developed an export trade, involving large-scale production, and this rendered it impossible for every journeyman or apprentice to become a master. Thence arose associations of workmen whose objects were to improve wages and hours of work. The guild system gave way by the 17th century to the system by which work was done on commission for a middleman, who supplied the raw material and sold the finished product.

The textile trades were the first to exhibit the characteristics of modern industry; as long ago as the 16th century they experienced over-production and suffered from changes in fashion. The invention of the steam engine and improved textile machines gave a great impetus to the growth of factories towards the end of the 18th century and they, in turn, introduced a number of problems relating to health, housing, and education. The last century was thus characterised by the growth of the factory system and with it the growth of legislation for the protection of the factory worker; the growth of the trade union movement; and the raising of a dividing wall between the so-called employer and employé. Already during the current century more progress has been made than in the whole of the preceding part of the industrial era. Four factors have contributed to this, the first of which is the rapid application of electricity for industrial purposes which has increased the productivity of the worker. Then there has been a general speeding-up of the rate at which we have increased our knowledge of natural laws and materials; the effects of the war and a growing appreciation of the importance of the human factor have also had their effect. The development and improvement of power-driven machinery have made it possible to concentrate huge industrial organisations upon the manufacture of one article, segregating the manufacturing operations to such a degree that each becomes basically simple and within the capacity of the unskilled to perform successfully. Thus mass production has come about with ever-widening markets, enabling selling prices to be reduced and high wages to be maintained.

The Principles of Modern Industry.

We have now reached a stage at which certain industrial principles can be defined and acted upon. Primarily any industrial process is concerned with the movement of materials according to an ordered plan, from the raw stage to the finished product, the combination of these transformed materials, and the sale of the resultant entity to a customer who pays for the service. It is of supreme importance to eliminate waste whether of labour or material, and the process of conversion can be carried out most efficiently when the flow in the industrial circuit is steady and continuous. Management is the directive force governing an industrial organisation and is a specialised art. Its function is to ensure that the shareholders, the customers and employés are fairly treated. It is realised that one of the bases of success is good service to the consumer in the matter of quality, price, and timing. The great importance of the human factor is appreciated and much is being done to improve the daily lot of the worker and interest him in his task. This interest extends to his spare time and the team spirit is fostered in many ways. The greatest good will come from the pursuance of the principles of high wages for high productivity, in association with reduced manufacturing costs.

Rapid as the evolution of industry has been in the past, the rate will always tend to increase, and it is of importance to endeavour to visualise the position which will eventually prevail. Civilisation can only be held together by the scientific type of mind such as the engineer possesses. Geographical boundaries are becoming less important and it is necessary to think in terms of world movements. The "team spirit" upon which an industry relies for success is even more necessary to humanity as a whole. The futility of war is becoming more and more realised and in all lands a spirit antagonistic to war is developing. The ideal of a universal brotherhood with a universal language (perhaps English) is rapidly moving in the direction of fulfilment. These world movements are having their effect upon industrial evolution. Even at the present time industrial activity knows no boundaries; such artificial barriers as have been erected will ultimately be swept away. In such a piece of plant as a transformer some forty-two materials are employed which have come from all parts of the world. The international character of the transformer is an illustration, in a greater or lesser degree, of all forms of industrial activity, showing the interdependence of different towns, states, or countries.

The Meaning of Rationalisation.

Rationalisation is but a phase of the continuous evolutionary movement in industry. It is "horizontal" in direction, *i.e.*, it brings into close association industries giving the same class of service, as opposed to the "vertical" combination which seeks to control the flow of materials from the earth to the consumer. In Germany, the birthplace of rationalisation, the process commenced as an attempt to ration output to the limits of the existing market demands, and simultaneously to reduce production costs in face of the handicap arising from the low load conditions obtaining in the various factories. Although the movement started in this way, it subsequently expanded to embrace all reasonable methods which might be conducive to improving the efficiency of the service rendered by any particular industry, increasing and cheapening production. The World Economic Conference at Geneva in 1927 defined rationalisation as "The methods of technique and organisation designed to secure the minimum waste of either effort or material. It includes the scientific organisation of labour, standardisation both of material and products, simplification of processes, and improvements in the system of transport and marketing." Hitherto the growth of industry in this country has been on intense individualistic lines, at once a strength and a weakness. In Germany the rationalisation movement started as long ago as 1893, in the coal industry. It took the form of the elimination of inefficient units of production; the ruthless modernisation of machinery and equipment; the intensified use of power and conveyors; and the extension of the economical use of coal within the industry itself and in allied undertakings. The result was increased output, lower costs and higher wages, but also the displacement of labour, which, however, was quickly absorbed during the revival which followed. The following are the fundamental principles which must govern the rationalisation movement:—The realisation of the supreme importance of the human factor; a thoroughly democratic organisation, in which a man is judged solely by his capacity; a recognition of the interdependence of workers, management, shareholders and customers; the elimination of waste, perhaps involving the scrapping of obsolete plant; high wages in association with high productivity; appreciation of the importance of the time factor; continued healthy expansion; and the ideal of service and brotherhood. As productivity will rise more rapidly than consumption, there will be a continuance of the move towards lower hours of labour; otherwise there will be little justification for this enormous expenditure of mental and physical effort. Another modern condition is the broadening of the ownership of industry, which may eventually lead to the position in which the workers in industry and those served by its products will become virtual owners through their shareholdings. This tendency is illustrated by the growth in the number of shareholders in the American General Electric Co. during the past 15 years.

Rationalisation in the Electrical Industry.

As regards the electrical industry, conditions in the United States were much more favourable to development than in this country. As a consequence electricity supply in this country is relatively backward. To-day about two-thirds of American homes are wired for electricity supply, whereas here the proportion is only about one-fifth. Thus there is a tremendous scope for expansion in this country. It is reasonable to assume that the rate of growth of the electrical industry in Great Britain will follow closely the law of the growth curve actually realised in the United States between 1915 and 1925. On this basis, with the present turnover at £70,000,000 or £80,000,000 per annum, the turnover of the electrical industry by 1940 will have reached the tremendous figure of £290,000,000 per annum. This country lives by its export trade, and the portion of the electrical export trade which it is able to secure will have a big influence upon the growth of the whole electrical industry during the next decade. During the past six or seven years Great Britain was successful in securing a little more than half of the orders for electrical machinery and apparatus from the Dominions. The demand for apparatus has grown more rapidly than that for machinery, indicating that expansion in the future will be

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brought about mainly by the increased turnover of small apparatus, which embraces all electrical appliances used in the home.

Figures published by the World Power Conference indicate that during 1927 electrical power represented only about 11 per cent. of the total power production of the world, showing that we have so far only travelled a little part of the journey, which must ultimately lead to the almost universal use of energy in an electrical form. This can be illustrated by the case of the British iron and steel industry, which employs electricity for only 41 per cent. of its power requirements as compared with 75 per cent. in the cases of the American and German industries. It is calculated that if the British industry was brought up to the same level, it would give business worth £1,120,000 to the British electrical industry.

One of the greatest difficulties which confronts the electrical industry arises from the fact that it embraces such a large number of separate and distinct businesses—from lamps, which can be produced on mass production lines, to turbo-generators which cannot. While it must be recognised that one of the greatest needs facing the industries of this country is that of moving continually in the direction of simplification and standardisation, this need in the case of the electrical industry is of paramount importance because of the very complexity of the problem which confronts the electrical engineer at the present day. This condition is worsened by the lack of uniformity in the system of electricity supply; the movement towards standardisation will take many years to gain its object, but when it is attained it will benefit the whole electrical industry. Every possible encouragement should be given to the British Engineering Standards Association, and throughout our schools, colleges and technical institutes standardisation and simplification should be inculcated. Simplification spells lower costs and lower selling prices, resulting in a great extension of the sphere of usefulness of an article. The degree to which research is encouraged and fostered in any particular industry controls, in great measure, the rate of progression that can and will be made by the industry. It is estimated that the rate of expenditure upon research in the electrical industry in relation to the turnover is only about a third of what it is in America. The healthy growth of the electrical industry is so important to the Empire as a whole that it does appear that the Government, whatever its particular colour may be, would be wise to give this problem of research more consideration, and any action which it might take to lubricate the wheels of research organisations throughout the land would re-act not only to its own advantage, but more important still, to the great advantage of industry, the people, and the nation.

United States Electrical Exports.

Two Years' Figures Compared.

BELOW are shown the values of electrical machinery and apparatus exported from the United States during the twelve months ended June last. Comparative figures for the twelve months ended June, 1928, are added and notes of increases or decreases are given.

	Twelve months ended June, 1928.	June, 1929.	Inc. or dec.
	Thous. $	Thous. $	Thous. $
Electrical machinery and apparatus (total)	87,192	102,846	+15,654
Generators—			
Direct current—			
Under 500 kW	1,023	1,230	+ 207
500 kW and over	926	560	− 366
Alternating current—			
Under 2,000 kVA	151	260	+ 109
2,000 kVA and over ...	850	80	− 770
Steam turbine generator sets	1,850	980	− 870
Accessories and parts for generators	1,210	920	− 290
Self-contained lighting outfits	1,309	1,110	− 199
Batteries—			
Flashlight batteries	2,619	3,370	+ 751
Other primary batteries ...	2,747	2,730	− 17
Storage batteries	3,511	3,500	− 11
Transmission and distribution apparatus—			
Switchboard panels, except telephone	2,095	1,385	− 710
Switches and circuit breakers over 10 amps.	1,868	2,015	+ 147
Fuses and fuse blocks ...	398	540	+ 142
Watt-hour and other measuring meters	665	1,220	+ 555
Volt-, watt- and ampere-meters, and other recording, indicating and testing apparatus	1,903	1,800	− 103
Lightning arrestors, choke coils, reactors, and other protective devices ...	795	925	+ 130
Motors, starters, and controllers—			
Motors under 1 h.p. ...	2,932	3,200	+ 268
Stationary motors—			
1 to 200 h.p.	2,796	3,560	+ 764
Over 200 h.p.	424	350	− 74
Railway motors	963	380	− 583
Electric locomotives—			
Railway	1,121	500	− 621
Mining and industrial ...	701	335	− 366
Starting and controlling equipment—			
For industrial motors ...	1,386	1,700	+ 314
For electric railway and vehicle motors	293	210	− 83
Portable electric tools ...	1,176	1,370	+ 194
Accessories and parts for motors	2,427	3,100	+ 673

	Twelve months ended June, 1928.	June, 1929.	Inc. or dec.
	Thous. $	Thous. $	Thous. $
Transforming or converting apparatus—			
Power transformers	1,797	2,260	+ 463
Other transformers	821	1,220	+ 399
Rectifiers, double-current and motor generators, dynamotors, synchronous and other convertors ...	1,792	1,000	− 792
Electrical appliances—			
Electric fans	885	1,065	+ 180
Electric lamps—			
Metal filament	1,396	1,415	+ 19
Other electric lamps ...	527	640	+ 113
Flashlights	2,637	2,580	− 57
Searchlights and projectors	678	650	− 28
Motor-driven household devices	2,277	4,500	+ 2,223
Domestic heating and cooking devices	1,415	1,300	− 115
Industrial electric furnaces and ovens	544	525	− 19
Therapeutic apparatus, X-ray apparatus, galvanic and faradic batteries, &c. ...	1,636	1,900	+ 264
Signal and communication devices—			
Radio apparatus—			
Transmitting sets and parts	620	1,100	+ 480
Receiving sets	3,133	6,265	+ 3,132
Tubes	1,022	1,345	+ 323
Receiving set components	2,467	3,340	+ 873
Receiving set accessories	2,576	3,460	+ 884
Telegraph apparatus ...	859	970	+ 111
Telephone apparatus—			
Instruments	329	740	+ 411
Telephone switchboards ...	433	800	+ 367
Other telephone equipment	2,665	2,620	− 45
Railway signals, switches, and attachments	749	800	+ 51
Bells, buzzers, annunciators and alarms	370	325	− 45
Other electrical apparatus—			
Spark plugs, magnetos, and other ignition apparatus	2,092	3,500	+ 1,408
Insulating material	1,312	1,385	+ 73
Metal conduit, outlet, and switch boxes	1,234	1,330	+ 96
Sockets, receptacles, and lighting switches	1,841	2,110	+ 269
Electric lighting fixtures, interior and street ...	2,247	3,100	+ 853
Other wiring supplies and line material	1,207	1,300	+ 93
Electrical apparatus n.e.i. ...	7,303	11,200	+ 3,897

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A Novel Electricity Meter.

Constructional Details of the "Rex" Fixed-charge Automatic Collector and Prepayment Meter.

THE "Rex" fixed-charge automatic collector and prepayment meter, fig. 1, provides for the automatic collection of the fixed or basic charge by instalments, in addition to the payment for current consumption. Not only does the meter fulfil the functions referred to, but it carries them out in such a manner as to create flexibility in applying the fixed-charge system that will appeal to all those who have made a study of the economics of electricity supply.

The fixed-charge indicator, 15, fig. 2, is set to the amount to be collected as a fixed charge, and it can be varied from time to time without the necessity of fitting any change wheels or suchlike devices, being a very simple means of collecting any payment that has to be made. In the same way, should it happen that the amount to be collected during the light quarter is not reached, it can be dealt with in one of three ways: (1) the balance due can be carried forward and added to the amount to be collected in the next quarter; (2) the fixed charge for the whole year can be divided into two amounts, and these be collected in the winter quarters; and (3) in cases where the consumer may be a doubtful payer the collector can trip the switch and ask for the payment of the balance of the fixed charge in cash.

The general operation is as follows:—The fixed-charge indicator dial 15 is set to the figures representing the amount to be collected. This is done by means of a small screw key which is inserted into an aperture 17 in the cover, which is opened when the coin box 19 is removed from the meter; thus the rest of the meter mechanism is still inside the sealed cover and cannot be tampered with by unauthorised persons. The dial 16 having been rotated by means of the key in a backward direction until the figure required is opposite the pointer 28, the coin box is then replaced which automatically closes the aperture 17. The figure and pointer indicating the amount owing on the fixed-charge account at any time is visible through a small window in the cover.

So long as the fixed-charge indicator shows a figure, each coin inserted advances the differential gearing 5 only half the full value, consequently the consumer gets half the coin value in current and the other half coin value goes as an instalment off the fixed charge. When the fixed charge is completely liquidated, the meter automatically disengages the half and half gearing 7, 8, 9 and 10, and for each subsequent coin inserted the full value of units is given. The actual kWh consumed are registered on the meter dials, and there is a reserve coin counter showing coins unconsumed 27. Up to thirty coins may be inserted at any one time. The two sets of gears marked 7, 8, 9 and 10 are so arranged that the differential gears 1 and 5 advance only a proportion of the value of the inserted coin, the remainder being arranged to automatically go towards liquidating the amount of the fixed charge. The price per unit is decided by the two change wheels A and B, of which a wide range of combinations are standardised.

The prepayment and switching and tripping mechanisms are especially interesting. The coin, when inserted, passes through a guiding channel and takes its position in the radial groove of the insertion disks I, the spindle of which is vertical; a curved sector acts as a guide for the coin, and should it not be correct value the coin drops into a separate compartment of the till without operating the meter. By pushing a handle, cams are set in motion and a quadrant carrier placed between the insertion disks is made to rotate, thus moving the coin ⅛ of a revolution, with the result that two rollers engage with a four-limbed star and bring into action a strong spring which carries the coin a further ⅛ of a revolution. The coin, guided by the curved sector, falls into the coin box.

A vertical spindle geared to the insertion disk spindle makes a ¼ of a revolution, and acts on a differential gear and moves the coin register and the reserve coin counter forward, one in each case. A small auxiliary contact is lifted by a cam fitted to the end of the differential gear; this opens the auxiliary circuit, and the end of the lever rests on the slope of the cam. After eight revolutions of the cam the lever falls again into the notch of the cam, if a second cam which revolves at ¼ the speed does not prevent it. This provides a high standard of accuracy for the opening of the switch, so that the impossibilty of the current value per coin being exceeded is made quite certain. The switch is tripped into position by the action of one of the four pins on the four-limbed star piece on the long switch arm or lever, which is held in the on position by the edge of a pawl mounted on the relay spindle, and this remains in position until the current circuit of the relay is energised and the switch tripped. On the insertion of further coins, the insertion disk moves ¼ of a revolution; the coins fall into the till or coin box, and their number is registered on both counters. As the current is used the kWh register at the top advances accordingly. The reserve-coin counter, working through a differential, counts off in proportion to the rate per unit, which value can be adjusted by the change wheels. These wheels act on the differential gear, thus moving the first cam until it reaches the position which corresponds with the zero of the coin register. The lever of the contact falls, makes contact, energises the relay, trips the pawl and releases the main switch. The whole mechanism is very accessible and is sup-

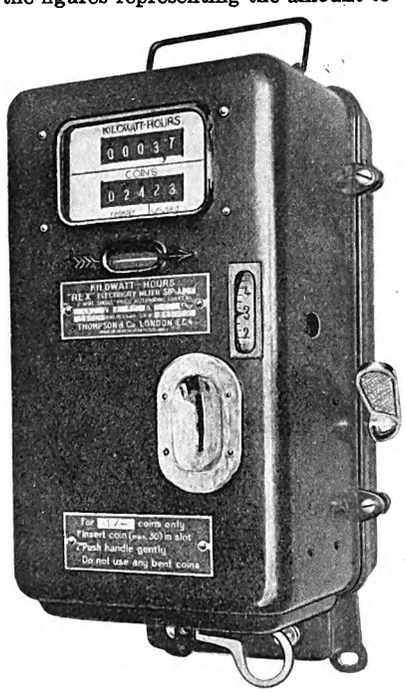

Fig. 1.—"Rex" Fixed-charge Collector and Prepayment Meter.

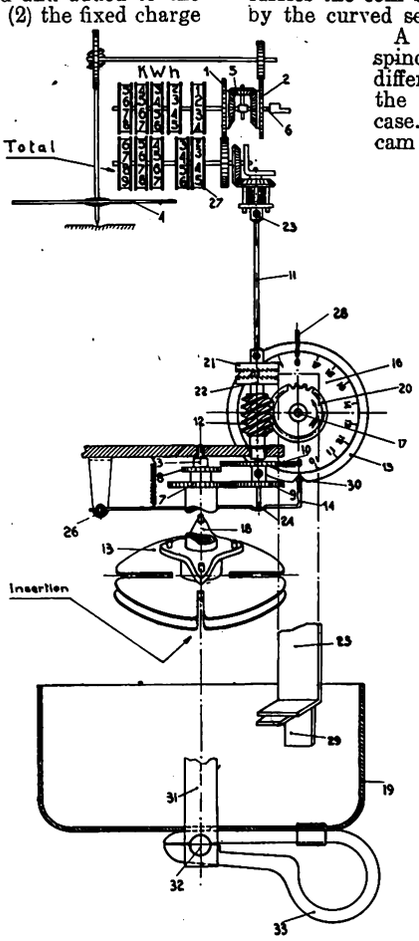

Fig. 2.—Construction of Fixed-charge and Prepayment Mechanism.

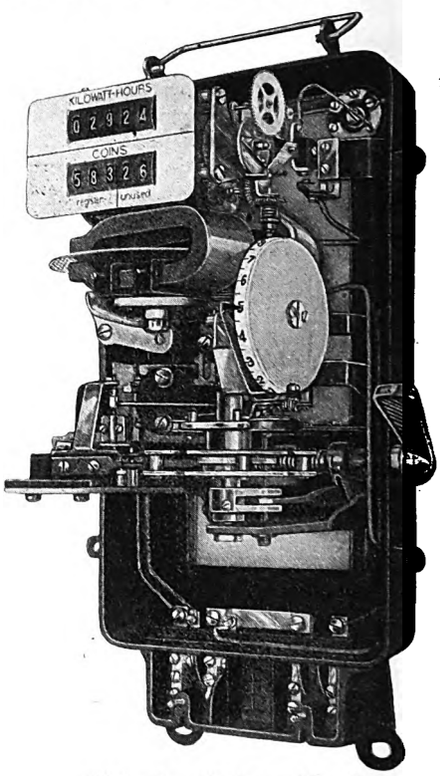

Fig. 3.—Meter with Cover Removed.

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ported on a good strong bracket casting fixed to the lower part of the meter base.

In addition to the fixed-charge collector attachment there are other very useful attachments which can be supplied for this meter if required. One of them is a fraud-proof device by which any fraudulent manipulation of the coin mechanism by the insertion of a piece of wire, thin strips of metal, or cardboard, is prevented and the meter rendered cheat-proof. Another attachment is a small tripping arrangement brought outside the case by which means the reserve coin dials can be reset to zero.

Fig. 3 shows the instrument with the cover removed.

Commercial Radio-Telegraphy.

The Present Position of Short-wave Communication Services.

(Extracts from a lecture delivered before the RADIO SOCIETY OF GREAT BRITAIN.)

THE recent lecture, illustrated with lantern slides and diagrams, delivered by Mr. H. M. Dowsett, M.I.E.E., before the annual convention of the Radio Society of Great Britain was of topical interest, owing to the fact that a few days later the control of the wireless telegraph services formerly administered by the Post Office and the Marconi Company was assumed by Imperial and International Communications, Limited.

The lecturer concerned himself with the manner in which those responsible for commercial wireless services had applied the knowledge gained during the last few years to the solution of short-wave propagation problems and of the operating technique which had gradually been built up, so that services had been established on an economic and satisfactory basis between this country and all parts of the earth. The "Empiradio" services, he said, provided the most striking example of successful commercial short-wave working, and were the outcome of Marconi researches.

The transmitter used for those services was of a design which gave great stability of wavelength, and 20 kW fed to the anode of the first magnifier provided more than enough power for high-speed working. The receiver was designed for strong signals, which were not mutilated by short-fade periods. During the three years since the first Imperial beam service was opened to the public, several types of projector aerial had been evolved and employed for commercial working in different parts of the world, but nowhere could they find a concentration of beam radiation equal to that provided at an "Empiradio" station. Numberless short-wave transmitters could be heard on the ether, many of them crystal controlled, but a careful watch disclosed that the "Empiradio" transmitter had a constancy of wavelength equal to the best of them, and that it was handling more traffic and continuiung in service without "sticks" for more hours than any other type of transmitter. Stability of wavelength was obtained by the extreme care taken in the construction of the set.

The routine at the transmitting stations was to start up the plant and keep it going. A continuous monitoring watch was maintained on both the incoming and outgoing signals, and, according to the conditions prevailing, the receiving station advised the London central telegraph office when to change the operating speed, the route, or the wavelength. Communication by one route, or on one wavelength, was continued until the singals one way or the other failed, when the route or wavelength was changed, when possible, at both terminal stations at the same time. Much of the success of a commercial wireless service depended on the effectiveness of the monitoring. If the quality of signals fell off, the operator at the C.T.O. was in a position to recognise faults due to bad keying or badly punched tape only at the other end. If it was due to any other cause than faulty transmission, he would conclude that conditions were worse, and he would be inclined to ask for the messages to be sent twice (which would drop the effective speed to half) or, alternatively, for the operator to send at a lower speed. The monitory operator on constant watch at the receiving station was, however, immediately able to diagnose the trouble, whether it was due to atmospherics, fading, echo, or jamming, or some fault in the apparatus or landline link. He saved traffic time by indicating the source, if it was at his end of the channel, and could often minimise it, or clear it altogether, by balancing the adjustments of his receiver, or by advising a change of wavelength, if the source was to be found in changes which were taking place in the physical conditions of the intervening medium between the two stations, or by interference from some other transmitting station.

In addition to the "Empiradio" beam services, which were a self-contained world system, another extensive group of circuits had its centre in London and was known as the "via Marconi" telegraph services. On 15 circuits those services transmitted on 17 wavelengths, seven long-wave and ten short-wave, and the traffic from the corresponding 15 stations was received on some 85 different wavelengths, 39 long-wave and 46 short-wave. Eight transmitters at Dorchester were worked simultaneously from Radio House, and signals from a similar number of stations were received through Somerton. The Brentwood receiving station now had some 24 long- and short- wave receivers employed on traffic circuits which used some 60 wavelengths within the wide range of 15 to 30,000 metres.

One had to realise, said Mr. Dowsett, that the wireless services of the whole world were interconnected commercially, and also to a large extent technically, and formed practically one network. If for any reason a particular service should break down, the "outside" network was at hand if need be to carry on the traffic.

Of the commercial wireless services of the United States, by far the greater number came under the control of the Radio Corporation of America, which sent out traffic on about 42 circuits chiefly with short-wave transmitters. The R.C.A. broadside projector antenna and the special method of reception devised by the R.C.A. for short-wave working were called by them the "diversity" system.

French short-wave commercial communications was worked by the State with two transmitting stations built by the French Government: one at Lyons (La Doua) and an auxiliary low-power station at Bordeaux (La Fayette), a further station at Pontoise (30 kilometres from Paris) being under construction and expected to be in operation at the end of this year. A corresponding receiving centre was under construction at Noiseux (25 kilometres from Paris). The example set by Great Britain in the use of aerials which transmitted beam radiation had been followed in France, as elsewhere, because the requirements of high-speed traffic compelled the use of a strong signal.

The German inter-European wireless service was worked by the Reichspost itself, at present only on long waves, but the oversea services were worked by "Transradio," all the short-wave transmitters being at Nauen and the receiving stations at Geltow, near Potsdam.

Architectural Lighting.

Report of an interesting discussion held at Birmingham under the auspices of the Illuminating Engineering Society.

THERE was a large attendance at the Birmingham Chamber of Commerce last month at a meeting held under the auspices of the Illuminating Engineering Society, at which Mr. Waldo Maitland read a paper on architectural lighting.

Dr. J. W. T. WALSH, of the National Physical Laboratory (president of the Society), presided and, having been introduced by Mr. W. Y. Anderson, of the Birmingham Corporation Electricity Supply Department, said that all who had the Society's interests at heart were looking forward with much confidence to the formation of the first provincial centre in Birmingham. It was felt that Birmingham would be the proper place in which to start a completely new chapter in the Society's history, and that the Society would never be able fully to do what it set out to do while it confined itself to London. That could be done only with the help of active, hard working, provincial centres. Meanwhile, those living in the country could become country members, with a subscription of one guinea instead of two, which was a substitution only, until the local centres were going all over the country.

Mr. WALDO MAITLAND then read his paper, which was submitted before the Society in London a few months ago, and accompanied it with many lantern illustrations of examples of architectural lighting on the Continent and in London.

Mr. JUSTUS ECK, who said he was an intense believer in illumination and was also interested in daylight illumination, regretted that the paper had not referred to that side of the subject, but the paper had a great timeliness. There would be an international illumination congress in 1931, and amongst the cities the congress was going to visit was the City of Birmingham, and he thought Mr. Maitland had had in mind some idea of there being examples of the illumination of which he had spoken in Birmingham in 1931. The absence of glare was one of the most important things in lighting, and undoubtedly it could be secured by the multiplication of the sources of light. One might have gained the impression from the illustrations that architectural lighting was a novelty confined to other

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countries, but it was not so. The first illumination of that kind was carried out at Windsor Castle in the time of Queen Victoria. The inspiration of that form of lighting had come, as had so many other things, from the brain of a Scotsman, Mr. Gordon Craig, the pioneer in stage lighting. He believed it was by Mr. Craig's work that the other countries were inspired. He seemed to gather the impression that that form of lighting was rather expensive, because there were so many units of light. They should aim at getting the central station authorities to offer a special rate for that form of lighting, which remained in use for a long period at a time generally when factories were not working, so that it helped towards securing a good load factor. One thing that had brought forward the possibility of good architectural lighting was the immense improvement in glass. It was a pity the illustrations they had seen did not show the effects of colour. It was difficult sometimes for those in the provinces to go to London and see the wonderful showroom of the Lighting Service Bureau, and it would be a good idea to have a model in Birmingham. He thought the Birmingham Corporation Electricity Supply Department should contribute its share in pioneering architectural lighting. It was a form of lighting which would also apply to private houses, where he thought it might find a very beautiful application.

Mr. E. A. REYNOLDS, chairman of the E.C.A., said their thanks were due to the lecturer for showing such extraordinary views of that form of lighting on the Continent. There were certainly not many examples of such lighting in England at present, and he would like the opinions of architects on the subject. In his opinion some of the arrangements did not quite meet his ideal of architectural beauty. In the illustrations the units were almost wholly rectangles and cubes, and he wondered why circles and spheres should be left out. The showroom of the E.L.M.A. bureau had been mentioned, and he most strongly advised everybody who had not seen it to go to London and do so.

Mr. W. A. JACKSON, chief engineer of West Bromwich, said one thing which appealed to him as a supply engineer was the marvellous load that might be got from that type of lighting. They should try and encourage the supply of electricity at 1d. per kWh for that purpose. He was somewhat sceptical, however, from the architectural point of view. That form of lighting might be very effective at night time, but it seemed to him that some of the arrangements detracted from the appearance of the buildings during the day.

Mr. W. P. PODBURY suggested the blending of daylight and artificial light, where both existed, so as to avoid glare.

The CHAIRMAN, in reply, said it was generally considered bad to blend uncorrected artificial light with daylight, but recent experiments had shown that perfectly satisfactory results could be obtained by the use of artificial daylight lamps. As proof of that he cited an occasion when he took a friend into a room where there was no daylight, only artificial daylight. The visitor looked round and said "Yes, that is very nice, and now will you switch on the artificial light." He had a shock when he knew it was all artificial light. Some people, however, found artificial daylight lamps a trifle cold, and preferred the warmer tone of uncorrected light, but they could not have it both ways.

Mr. J. S. DOW commented upon the fact that most of the illustrations were of shops, restaurants, and theatres, and asked if there were any examples of that form of lighting being applied to public buildings of distinction, because in that way they would get the real possibilities of architectural lighting. One or two public buildings had been built recently in which the lighting was of architectural type. There was the further consideration that the diffusion of light helped materially in the illumination of streets, but some of those buildings obviously required an immense amount of electricity. He believed some of the buildings which had been illustrated took an amount of electricity similar to that which would be required for a town of the size of Epsom or Windsor. Perhaps Mr. Anderson would say how he would like a load equivalent to that of a small town being added to his total load for a short time only.

Mr. ANDERSON said it would not mean a big load all the time, and they would be very glad to have it. The author had given them some very excellent ideas in shop lighting. They had one or two shops in Birmingham in which small block units of reflected or deflected light were used, and he had made a point of speaking to the owners about the cost. It was interesting to learn that it had been their experience that their lighting consumption was less than was the case when ordinary light was used.

Mr. MAITLAND said the price per kWh was generally about 3d.

Mr. WM. DOUBLEDAY, the Birmingham architect, said the paper was an extremely interesting one, and he was sure they would pursue the subject into which Mr. Maitland had initiated them. Personally, he thought indirect lighting most preferable on the ground that it was most acceptable to the eye and less injurious than direct lighting.

Mr. SMITH was of the opinion that the new Carreras building in London was a finer example of that form of lighting than any of the illustrations they had seen.

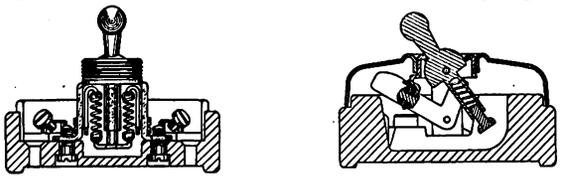
Mr. MAITLAND, replying, said that to get good architectural results in lighting it might be that they would have to sacrifice a little in practicability, and it must be borne in mind that effect was the main thing.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

A New Tumbler Switch.

A new quick make and break switch with a patent compensated spring action has been introduced by Messrs. RAINSFORD AND LYNES, LTD., Emily Street, Birmingham. This switch, whilst conforming to modern design in a general manner, incorporates in its action a compensated spring device employing three rustless-steel springs. These are so arranged that two dead-centre tension springs are anchored to the moving contacts at one end and to a sliding plunger at the other end, the plunger being acted upon by a compression spring housed in the dolly. From the accompanying diagrams (figs. 1 and 2), it will be seen that movement of the dolly extends the tension springs until the fulcrum line is passed, when the springs react



Figs. 1 and 2.—The Action of the New Rainsford and Lynes Switch.

to make or break the contact. The compression spring meanwhile compensates the action of the tension springs, giving the whole movement a soft, smooth action and the contacts an almost instantaneous function free from any preliminary movement. As the operating strain is shared by three springs, the life of the switch is considerably lengthened. The fixed contacts are manufactured in one piece, of phosphor-bronze, and the whole assembly is of British manufacture.

A New Interlocked Switch-Plug.

The GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, has recently introduced a new interlocked switch-plug,

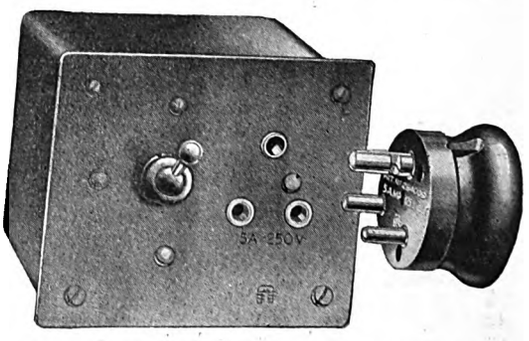


Fig. 3.—"Magnet" Interlocked Switch-Plug.

which incorporates special features ensuring absolute safety in operation. The apparatus, fig. 3, is of the flush type, and consists of a quick make-and-break switch and a three-pin plug. Mechanical interlocking devices are fitted, which prevent the switch being operated when the plug is not in position, and prevent the plug being withdrawn when the switch is "on."

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Accidental contact with the live socket tubes is, therefore, entirely eliminated. The general appearance of the switch-plug is neat and pleasing, and the position of the switch in relation to the plug is so arranged that the complete unit in its iron box is fixed in a horizontal position, which is acknowledged to be the most suitable for skirtings, etc. The brass flush plate is available in a variety of finishes, the standard finish being Florentine bronze. The device is made in two sizes, 5 A and 15 A, and the plug pins and socket tubes are made to gauges as specified in B.E.S.A. Specification No 317 (1928). I.E.E. Regulations are fully complied with and a visible earth terminal is provided to meet with Home Office requirements. The "Magnet" flush type interlocked switch plug thus provides a safe and efficient means of control for appliances that are connected to the supply by flexible conductors.

A New Thermionic Relay.

MESSRS. BAILY GRUNDY & BARRETT, LTD., 2, St. Mary's Passage, Cambridge, have recently produced a thermionic relay particularly for use in connection with temperature control apparatus and designed specially for a laboratory doing important research work where temperature control is required within 1/100 deg. C., and owing to the prolonged nature of the experiments absolute reliability is essential. A thermionic valve, supplied by a small transformer with a filament, anode, and grid potentials, operates the main contactor switch by means of the anode current, the thermostat, connected in the grid circuit, effecting control by application or non-application of a suitable potential to the grid. By the use of the thermionic relay, the following advantages over the usual low-voltage magnetic type of relay are obtained: elimination of batteries, and direct operation from alternating current supply; reduction of current in the thermostat to a negligible quantity, approximately 10 micro-amperes; the reduction of moving parts and small contacts to a minimum.

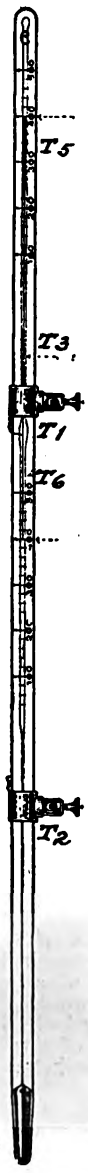

Fig. 4.—The Thermostat.

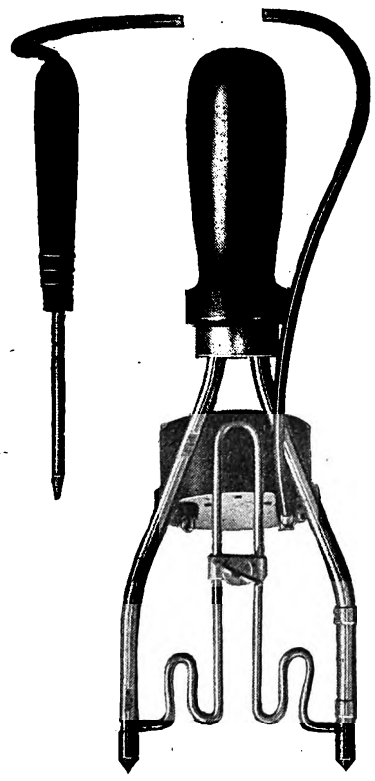

Fig. 5.—CTL Heavy-discharge Cell Tester.

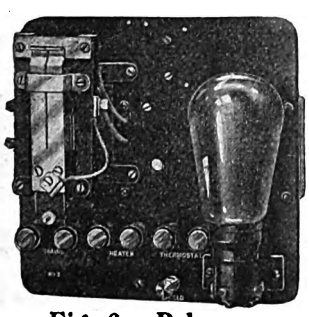

Fig. 6.—Relay Panel.

A thermostat with a fine mercury column can be used, giving very sensitive control, the surface of the mercury remaining clean after prolonged use; the relay can be operated through an external resistance of from 1 to 2 megohms, enabling a semi-conducting fluid to be employed in the thermostat, if required, with low running cost. The thermostat, fig. 4, is similar in construction to a glass mercury thermometer, but in addition contains two contacts T1 and T2, one of which T2 makes permanent contact with the column of mercury, and the other is connected to a small spiral T3 of platinum wire. A small glass capsule T5, containing a short piece of iron, is located at the top of the thermostat tube, to which is attached a length of platinum wire T6, passing through and making contact with the platinum spiral T3. The capsule can be moved up and down in the tube by means of a permanent magnet applied externally, and hence the thermostat can be arranged to make contact at any temperature desired. Fig. 6 shows the relay panel with the cover removed.

New Aerial Cable Unions.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs., have recently developed a range of cable unions covering copper, aluminium and steel-cored aluminium cables. The union

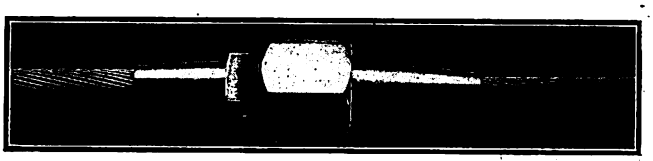

Fig. 7.—Union for Steel-cored Cable.

designed for steel-cored aluminium is of special interest in view of the large and increasing use of this type of conductor. It is claimed that joints can be made in the field in half the time required by earlier methods. No special tools are required, two ordinary spanners of suitable size being sufficient for tightening up. The union gives, it is claimed, in the completed joint 100 per cent. conductivity and 100 per cent. mechanical strength of the complete stranded conductor. The design, which is patented, has the further advantage that the line may be disconnected, if required, by the simple operation of releasing one nut, without disturbing the strands of the conductor or the clamping devices. In fact, it may be uncoupled and coupled up again as simply as an ordinary pipe union. The unions for use with plain copper and aluminium strands are very similar in design. They give 100 per cent. conductivity, and not less than 95 per cent. of the mechanical strength of the stranded cable. Figs. 7 and 8 show, respectively, unions of steel-cored aluminium cables and pure aluminium conductors.

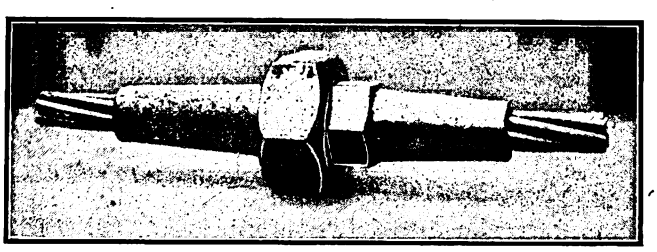

Fig. 8.—Pure-Aluminium Cable Union.

Cell-testing Voltmeters.

Two further developments of their open-circuit cell-testing voltmeter are being placed on the market by Messrs. FERRANTI, LTD., Hollinwood, Lancs., each embodying one of their 2½-in. dial and scale moving-coil voltmeters. Type CT2 is a two-range instrument reading 3-0-3 and 0.3-0-0.3 volts, the range desired being selected by means of a small switch mounted on top of the instrument. This model is claimed to be particularly suitable for good cadmium-test readings, as the same length of scale is available for cadmium-to-positive, cadmium-to-negative and open-circuit voltage readings. A cadmium stick adapted for fitting to the instrument can be supplied.

Type CTL is a "loaded" cell tester, fig. 5, which has been designed to permit of the rapid testing of cells under heavy discharge conditions, and is primarily intended for car-battery work. With the "wander-spike" in position in the clips provided, the two prongs are placed across the cell to be tested, and the shunt, which is permanently connected across the two prongs, puts a heavy load on the cell. In this manner, it is possible to obtain rapidly an indication of any variation in terminal voltage under heavy discharge conditions.

A novel feature is the introduction of a slider, which short-circuits a varying length of the shunt, thus giving a different value of discharge current for each position of the slider. An approximate scale is engraved on the back of one of the prongs of the tester, standard settings being 100, 150 and 250 amperes. It is very important to maintain clean contact surfaces between the slider and the shunt, and to screw up the slider as tightly as possible. By removing the "wander-spike" from its clips, open-circuit tests can be made by applying this spike to one terminal of a cell and either of the prongs of the tester to the other.

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Electricity and Fuel.

Extracts from Sir David Milne-Watson's Presidential Address to the Institute of Fuel, presented at the annual conference held in London.

PROBABLY no aspect of our national economy has undergone such a complete metamorphosis in the past quarter of a century, as regards both character and complexity, as the fuel situation.

During the 1914-18 European war period, in all countries and particularly in our own, a national fuel conscience was awakened after a period of lethargy occasioned by the past years of cheapness and plenty, which factors, with others, had the effect of lessening the demand for coal, with consequent over production.

Of all the various fruits of the various Royal Commissions and Government Committees that have examined and reported upon the successive crises which have arisen, none has secured greater publicity or more concentrated public attention than the national electricity scheme. Although several years must elapse before the results of the intended standardisation and centralisation of public electricity supply can be fully appreciated and judged, certain results are already being achieved. The application of the best steam engineering practice (large boilers and turbines working at high pressures and temperatures in accordance with the best thermodynamic principles) and the tendency to try new paths reflect very great credit on the electrical industry, both manufacturing and operating. To have secured an increase in energy output since 1921 of 90 per cent. with an increase in fuel of barely 25 per cent. is an achievement which we, as fuel economists, can appreciate and applaud; nor has this beneficial action reached finality, as even to-day the average fuel consumption per kWh generated is nearly 50 per cent. in excess of the best practice. It is well, however, to bear in mind that these considerations refer only to the public electricity supply undertakings. It is to be regretted that statistics relating to the vast amount of private electricity generating plant or to the still greater quantity of direct driving power plant are not available in so detailed a form or of so recent date.

The most recent statistics are contained in the Census of Production for 1924 and a perusal of the figures brings to light many interesting facts relating to the use of power. It is, for example, somewhat surprising to find that of nearly eight million horse-power of electric motors installed, 43 per cent. were then dependent upon privately generated electricity. It is obvious that the national aggregate electricity consumption must greatly exceed that shown by estimation based only on the sales of the public supply undertakings, and that the national use of electricity must approach much more closely that of Germany and America than pessimists would have us believe.

It is probable that in the course of time a proportion of the private power plant will be shut down and the electricity obtained from the national lines, but meanwhile they will continue to exist, especially where the generation of power is combined with a demand for steam for process work, or with the production of steam from waste-heat, or with other factors making for extreme cheapness of generation. In addition to private electricity generating plant of over 3½ million horse-power, there was at the time of the Census plant producing a further 7½ million horse-power for direct driving, the total private power plant being, therefore, 11 million horse-power. This has been developed and replaced according to the requirements, progress, and fortunes of the individual industries. In many cases electric transmission has been adopted, which in turn has paved the way for the introduction of the best type of prime movers. The fuel consumption of these plants, so far as can be estimated, shows, however, that there exists a wide field for the application of the skill of the fuel engineer and chemist. In certain instances, notably at collieries, the quality of the fuel used would render it unsaleable if it had to bear transport costs, but in most cases such industrial power plant was developed in days when coal was cheap, when power charges formed a small proportion of factory costs, and when reliability was the chief asset. In consequence, it has been developed, in many cases, in the wrong atmosphere, if considered in the light of present day requirements.

Mistaken Anticipation.—To my mind a great mistake is being made by those who see the millenium in the transference of all this generation of power to the national "super"-stations. In many cases the present methods are highly efficient, being either incorporated in cycles of process operations, or associated with special local circumstances. In some other cases, the application of mechanical stoking, pulverised fuel, higher steam pressures and temperatures, combined with efficient control of operation, would achieve results equal to those of the public electricity schemes, and at a lower cost, especially after taking into account the necessary losses due to the transmission of the electricity. Moreover, the money would be expended, not on the standardisation of the mechanical and electrical position of the present day, which would have to be retained for, say, twenty years, but in regular advancement from time to time by the substitution of newer plant embodying the improvement gained by those years of experience.

For example, at the various works of the Gas Light & Coke Company the generation of steam from heat previously escaping to the atmosphere has been extended so that 60 per cent. of the total amount of steam consumed is raised in this way. The cost of the steam is less than one-seventh of that raised by fuel-fired boilers, and its ready availability has led to the introduction of electricity generation for works' power on a fairly wide scale, inasmuch as when capital charges are excluded, energy can be produced for as little as 0.15d. per kWh in the most recent installations and at not more than double that figure as an annual average cost of generation in all of the company's 14 power stations, ranging from 100 to 5,000 kW capacity, which are now supplying 14 million kWh per annum. At the Company's chemical works a different procedure is adopted, electricity being produced from back-pressure turbine plant and the exhaust steam used for process work. There, under favourable conditions, the cost of generation is equally low at 0.15d. per kWh, excluding the capital cost, and does not exceed an average of 0.23d. per kWh; 2½ million kWh are generated annually at the works.

Thermal Inefficiency.—Admirable, however, as is electricity as a means of transmitting power, as a source of heat energy in general it is thermally inefficient. With the very finest generating, transmitting, and converting apparatus, the heat that can be delivered to a consumer must necessarily be under 20 per cent. of that contained in the original fuel, whereas gas, oil, and solid fuels can in many cases yield overall results far superior. It is regrettable that no estimate of the heat requirements of industry has yet been made, but no one with an intimate acquaintance with the subject will deny that heat, whether at high or low temperatures, in large or small amount, and under varying requirements as to nicety of control, is just as essential to production as power.

Probable Hindrance to Progress.—On those grounds alone I foresee much delay to progress resulting from excessive attention paid to the development of electricity and the corresponding neglect of the benefits available from the organisation of the carbonising industries, and from ordered attention to the heat and power requirements and production methods of individual industries.

For many years the sale of gas has increased steadily at an average rate of 3 per cent. per annum. The demand for gas in spite of the severe competition from electricity and other fuels steadily increases, but, though it may be possible at reduced prices to obtain a larger market in the industrial field, one would have to be unduly optimistic to assume that an additional output of gas from coke ovens could be absorbed otherwise than by displacing the gas now made by existing gas undertakings. The advantage to collieries of the replacement of the sale of raw coal by its carbonisation near the pithead is not the only side of the question to be considered. The disadvantages that may ensue to gas consumers in the future owing to the control of gas manufacturing costs passing to the colliery owners must receive no less serious consideration. The effect upon the coke market, which plays an important part in determining the price of gas, which would be caused by the entry of the non-statutory coke oven industry into domestic gas supply may be well illustrated by considering the effect of manufacturing the aggregate gas demand of all the authorised gas undertakings for last year in coke ovens. The production of coke in the coking industry amounts to some 1.8 to 2.3 cwts. per 1,000 cu. ft. of surplus gas; that is, 3½ to 4½ times the production by the gas industry for a similar quantity of gas. Instead, then, of a production for sale of 7.7 million tons of coke there would have been at least 27 million tons to have been disposed of. No words of mine are needed to point out the effect of throwing this much increased quantity of coke upon a market as yet undeveloped to receive it.

Smoke Abatement.—Idealists have often pictured this country with the whole of the 40 million tons consumed annually replaced by smokeless fuels, solid and gaseous, aided by electricity. I have not yet seen any estimate of the effect which so great a change in our national habits of coal using would have upon the price of coal to the coal-treating industries. Be that as it may, the practice of coal cleaning has now been extended to over 25 per cent. of the total of all British coal mined, and with a better understanding of the art of fuel utilisation the practice of buying coal upon performance, if not by definite analysis, is increasing. Whether

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the intention is to burn coal in one stage for the generation of electricity or power, or to carbonise it and burn or gasify the coke, the resulting ash is a bugbear which causes difficulties all along the line.

The emission of dust from pulverised-fuel burners should be curable by the adoption of high-voltage electrical precipitation apparatus, but pollution by non-visible gases, such as sulphur dioxide, does not seem so easy of solution. It does not seem to be appreciated that the sulphur freed by the combustion of coal for the production of electricity, which would return about 20 per cent. of the original heat energy of the coal at the consumers' apparatus, would be exactly the same as the amount that would have been released in the aggregate from many hundreds of domestic chimneys had the coal been burnt to provide heat, the normal efficiency of the open coal fire being also 20 per cent. In the case of the various carbonising processes at least one-third of the sulphur in the coal treated is definitely removed in the process of manufacture, and so does not reappear in the combustion of the products. It has been proposed to wash power-station flue gases to remove the sulphur, and the cost of so doing and the prospects of commercial success will be watched with great interest. The policy of the concentration of the generation and utilisation of energy, in whatever form it is carried out, inevitably results in difficulties and unnatural disturbances which become more prominent because of their concentration. It is a phase, unpleasant perhaps, in the development of civilisation which has to be acknowledged, and the effects of which will be conquered so soon as the major operations have really settled down into regular working order. In the meantime, whilst always keeping the ideal before us, we must not allow progress which benefits the whole community to be unduly hindered by sympathy with a small minority.

Water Power.—Cheap hydro-electric power can only be secured at the expense of the beauty of the countryside. Whilst recognising that where genuine benefits are secured by large numbers of the community, there is always a possibiltity of collateral disadvantage being caused to the minority, we must not allow the principle to be extended too far. For example, recent suggestions would have the effect, in many unprejudiced persons' minds, of spoiling the beauty of the Highlands by the promotion of hydro-electric schemes which, on the promoters' own showing, offered no advantage to the consumer over fuel-fired stations more conveniently situated.

More Co-ordination Required.—Concurrently with development, technical knowledge is now required from the worker in the factory and the wife in the home, as well as from the research worker and the administrator. There is a further need for the co-ordination of information, the spread of knowledge in different industries, and for improved liaison between allied industries to avoid duplication of effort and waste of energy.

Welding in America.

Comments on Factory Applications.

(*Extracts from a lecture delivered in London before the* Institution of Welding Engineers.)

SOME impressions of American industries, including electric welding, gained during a tour in the U.S.A., were described in a lecture delivered recently by Mr. E. A. Atkins, whose visit was made purely for the purposes of a holiday, but he accepted some of the many invitations he received to visit various industrial concerns there.

Although prior to the war welding practice had been very much more advanced in the United Kingdom than in the United States, he said, America had since jumped ahead in an extraordinary manner so far as welding operations were concerned. He was treated with the greatest kindness and courtesy at the various works visited, and invariably had been allowed to inspect all the processes, research laboratories, and everything else. American manufacturers were not afraid of allowing each other to know something of their respective businesses, and he believed they profited considerably as the result of that policy.

He had been greatly impressed by the magnitude of the educational institutions in America. At the colleges and universities there were chemical and physical laboratories, workshops, &c., all presented to the institutions by wealthy donors, and each building bore the name of the donor. American youth was crowding into educational institutions, and frequently men holding such positions as those of foremen had graduated at universities.

A great deal of research was being carried out in all directions, and the research laboratories of the Bell Telephone Company in New York were the most astounding he had ever seen. There was a series of laboratories at which 4,700 people were employed, and they were run quite separately from any manufacturing processes. They were subsidised by a definite percentage of the profit of the Company and all kinds of investigations were carried out, some of which were not exactly relevant to the telephone.

Among the works visited were those of the General Electric Company at Pittsfield, which employed 7,000 people, and he had been surprised at the extent to which welding processes were carried out there. The lugs of transformer casings, for instance, were not bolted and riveted on, but were welded on *en bloc* by an automatic system, the casings being slung over a large bar or beam during the welding operation; many methods of automatic welding had been developed. In the welding of sheet metal for steel tubing by the carbon-arc method, the filling material was laid right along between the two edges of the sheet and the carbon are travelled along and fused it in. Spot welding was used very commonly for all kinds of small joints, sheet-metal work, and so on.

The multiple-flame method of welding sheet metal was new to him: two, four, or more tips could be used; one tip of each pair of tips was above the sheet and the other below. The flames were regulated, and the sheet metal was mounted on a machine and passed through the flames at a speed which was regulated in accordance with the gauge of the sheet, the process being made either semi- or completely automatic.

Welding was used extensively for very many purposes; for repairing various articles, such as wheels, brake shoes, &c., and the construction of other articles, including reels, which were made by welding together ribs of sheet- or plate-metal. His own experience of the use of such reels had proved that they were very strong, and they appeared to be almost everlasting. Welding was also applied extensively in road consteruction, for welding reinforcing wire into panels and for jointing pipes.

Electricity was available almost everywhere. In a report he had read, to his astonishment, that on the average the distance between the source of electricity supply and the point at which it was used was 22 miles; it followed, therefore, that in some cases it must be transmitted enormous distances.

It appeared that there was a big future for welding in structural work; the height of one building had been increased from 8 to 15 storeys, and, as it was obvious that the stanchions used for the original building were too weak to carry the load of the additional storeys, they were strengthened by the addition of stiffening ribs to their sides by means of electric welding. Welding was also applied to steel structures to reduce corrosion; one of the disadvantages of rivets or bolts was that corrosion occurred much more rapidly at the riveted or bolted joints than at other parts of the structures, because water lodged there, and welding was resorted to for filling up the corroded portions.

The latest type of welding on record was the atomic hydrogen method in operation at the General Electric Company's works. The source of heat was an electric arc; hydrogen was blown on to the outsides of the arc, usually by two tips, the result being the production of an absolutely non-oxidising arc zone. The claim that it resulted in a wonderful deposit he could confirm, for never had he seen such a pure deposit of metal. The General Electric Company used it for welding together refrigerator parts, but he was not prepared to say whether or not it would find an extensive commercial use, because it was more expensive than the ordinary electric-arc or oxy-acetylene methods. It might be that somebody would develop some other method of surrounding the arc to keep oxygen away. The weld could be bent like a piece of lead, and when examined under a microscope it was seen to be solid, consisting of almost pure iron, free from slag or any oxide inclusion.

Speaking generally, he said, there was not very much advance in America with regard to welding methods, other than in the direction of the atomic hydrogen method, but there was not doubt that the Americans were going ahead with that. He had been impressed, however, with the manner in which they tackled things in bulk: at the Pittsfield works of the General Electric Company he was told that they had been very dubious about the adoption of welding for a long time, but as soon as they had found it could be done properly it had been used very extensively.

Many welding machines were coming into common use with a view to cheapening production, and there seemed to be very little resentment on the part of the workers to the introduction of the machines. Though he had been told that there was a great body of unemployed in America, he had not seen evidence of it; on many occasions he had seen placards on factory gates indicating that men were required and wages were good, as were also the conditions.

In the South American oilfields the oil tanks were welded structures. Welding was applied there also to the jointing of pipes, the repair of various pieces of machinery, &c. The automatic welding process was carried out quite well by native welders.

Replying to a question about the types of electrode used generally in America, Mr. Atkins said the Americans liked bare electrodes, but in some cases they used flux-coated and in others lagged electrodes; it all depended on the conditions and the class of joint required. The General Electric Company used the atomic-hydrogen welding method to get the tightest possible joint. In many cases the electrodes used in the U.S.A. appeared to be thinly coated.

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Electricity Supply.

A review of the progress which has been made during the last fifteen years in matters appertaining to the production of electricity.

By Thomas Roles, M.I.E.E.

(*Extracts from the chairman's address before the* North Midland Centre *of the* Institution of Electrical Engineers.)

ALTHOUGH disappointment is often expressed at the tardy progress made in the reorganisation of the electricity supply system in this country since the passing of the Electricity (Supply) Act of 1919, I feel it must be conceded that the country has to a considerable extent benefited by the work which has been carried out by the Electricity Commissioners, as, since their appointment, far greater attention has been paid to economy in generation by those responsible for the operation of electricity undertakings than was previously the case. The fact that it was generally known that it was intended wherever possible to shut down the smaller generating stations has stimulated electrical development, in that it has caused those responsible for the management of small stations to make strenuous efforts to find load with a view to justifying their stations being enlarged to such a size that they could be retained in use in connection with any schemes which might be put forward for their districts. The fact also that economy in coal consumption would have a considerable bearing on the extent to which a station would be utilised in the future has caused station engineers throughout the country to vie with each other in the production of electricity with the smallest possible consumption of fuel. The outcome of this has been that during the past nine years the amount of coal consumed per unit generated has fallen from an average of 3.32 to 2.05 lb., representing a saving of 1.27 lb. Had the 10,377,107,062 units generated in steam stations, as given in the latest report of the Electricity Commissioners, involved the consumption of the average figure of 3.32 lb. of coal per unit generated, as in 1921, the consumption of fuel (converted to a basis of coal) would have been 15,399,868 tons, as against the actual consumption of 9,516,419 tons, which shows that a saving of no less than 5,883,449 tons has been effected. It may thus now be fairly claimed that, quite apart from any advantages which will be gained as a result of the Central Electricity Board's operations, the attainment of the position stated to be desirable in the report of the Coal Conservation Sub-Committee is well on the way to being accomplished.

Government interference with the electricity supply industry is stated by many to have retarded rather than encouraged progress. While sympathising with many of the views put forward in this connection, on the whole, the interest displayed by successive Governments in our industry has been productive of beneficial results, as the fact that the provision of an ample and cheap supply of electricity throughout the country has been made a plank in the platform of each of the political parties cannot fail to have had considerable advertising value and the public demand for electricity has thereby been greatly stimulated.

In 1920 the North Tees power station was started, the first installation of steam-raising plant in which comprised ten boilers each having an evaporative capacity of 42,000 lb. per hour, operating at a steam pressure of 475 lb. per sq. in. and a total temperature of 700 deg. F. Re-heating was adopted, as were also the extraction of steam from the main turbines for feed-water heating and the preheating of air for the furnaces. The turbo-alternators were each of 20,000 kW at 2,400 r.p.m.

In spite of the notable increase in steam pressure at the North Tees station and the introduction of such refinements as re-heating, the general tendency in connection with power station design was still to keep to more moderate steam conditions. By 1921 boiler-house efficiencies of about 80 per cent. had been recorded, steam installations for pressures of 250 lb. per sq. in. had become common, and a number were either at work or under erection to operate at a pressure of 350 lb. per sq. in. Greater developments in connection with the increase of steam pressures were, however, being made by American engineers, and a number of stations were constructed in the States in which the steam plant was designed to operate at pressures of from 500 to 600 lb. per sq. in. and in 1925 the Edgar station of the Edison Electric Illuminating Co. of Boston, in which steam plant to operate at 1,200 lb. per sq. in. was installed, commenced to operate. Since then other plant has been built in America to work at still higher steam pressures, and it is reported that two boilers will shortly be put into use over there to produce steam at a pressure of 1,840 lb. gauge.

At the present time there is still no power station belonging to a public electricity supply undertaking in Great Britain which has boilers working at a higher pressure than those at the North Tees station, and until very recently no other boilers in this country were operated at so high a steam pressure. During this year, however, several very large boilers designed to work at a pressure of 800 lb. per sq. in. have been erected and put into commission by Synthetic Ammonia & Nitrates, Ltd., at Billingham-on-Tees. A boiler and turbo-alternator constructed to operate at a pressure of 1,100 lb. per sq. in. gauge will shortly be put to work at Bradford, and statements have been made to the effect that a large manufacturing concern in the South of England intends to install boilers for working at a pressure of over 1,800 lb. per sq. in.

Turbo-alternators are now being built in this country to operate at a speed of 3,000 r.p.m., having a capacity of 30,000 kW at 0.8 power factor, and sets of 67,250 kW capacity to run at 1,500 r.p.m. are on order for the new Battersea station of the London Power Co.

In the United States of America very much larger machines are at work, one at the Hell Gate station of the New York Edison Co. being of 160,000 kW capacity and another built for the State Line Co. of Indiana being of 208,000 kW capacity.

As indicating the progress which has been made by British steam-operated power stations, six stations have thermal efficiencies exceeding 20 per cent., the highest figure recorded being 21.35 per cent.

As members of the Institution we may feel proud of the part which has been taken by our Institution as a whole and by its members individually during the period covered by this retrospect. The membership, which was 7,045 in 1914, has now risen to 13,561, and its annual income from subscriptions from £15,454 to £34,693. It is gratifying to note that additional applications for membership continue to be received in large numbers, and the accession of strength thus being obtained will tend still further to increase the importance and influence of the Institution.

Railway Electrification.

The benefits and result from the conversion of suburban lines in thickly populated districts do not apply in the case of through passenger-carrying main lines.

TAKING railway engineering and transport as the subject of his presidential address to the Institution of Civil Engineers, Mr. W. Wylie Grierson, C.B.E., commented as follows, *inter alia*, on main-line electrification:—

The superiority of electric over steam traction for underground passenger railways has been definitely established. The advantage of electric power in the case of suburban lines giving access to and through densely populated areas is now fully recognised also; but, while the advantages of electric traction in the case of railways of the character referred to have been demonstrated, it is at least doubtful whether the adoption of electric traction for through main lines would, under existing conditions in this country, prove economically advantageous.

No country other than Switzerland has electrified more than a comparatively small proportion of its total railway mileage, as indicated by Table I, applying, from a railway point of view, to the more important European countries, the figures excluding narrow-gauge railways and those of a tramway character. The figures are and must be arbitrary, for it is difficult to define exactly the distinction between tramways and railways, and suburban and main line electrification, but they may be accepted as indicating the general position:—

TABLE I.

	Route Miles Electrified Track.	Railway Total Route Mileage.
Switzerland	1,203	1,943
Germany	1,010	33,350
Italy (State Railways)	1,005	9,910
France	754	25,990
Great Britain	620	20,243

A part only, however, of the electrified track occurs on main through lines as distinguished from suburban lines, and, if the mileage of the latter be deducted, Table II shows the percentages of total route mileage which have been electrified for main line through traffic.

TABLE II.

	Per cent.
Switzerland	61.9
Italy (State Railways)	10.1
France	2.5
Germany	2.5
Great Britain	0.0*

* If a mineral line 21 miles in length be excluded.

A feature common to the continental countries is the availability of water for the generation of electric power, while a further similarity of conditions is the non-existence of native coal in Switzerland and Italy, and the partial dependence of France, more particularly in the centre and south, on imported supplies. A third feature, common to Switzerland and the districts in Italy in which electric power is being, or has been, substituted for steam, is the comparative steepness of the grades, and the consequent limitation of loads and speeds, and

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for conditions such as those the power of the electric locomotive to haul greater loads at higher speeds is obviously of great economic value.

In this country the grades of through main lines are not generally severe, and the steam locomotive is capable of hauling a passenger train at a speed as high as is generally required, or perhaps even considered desirable; while the length, and therefore the weight, of trains is controlled by the length of platforms rather than by the limits to the power of the locomotive. Water power, moreover, is not available in this country in large quantities, while coal exists in abundance.

The main advantage resulting from the electrification of suburban lines in thickly populated districts, namely, the increased service of trains it is possible to run, would not apply to fast non-stopping trains on main lines, and would be of small value in the case of local trains when the number is few, and the gain in time, due to the greater power of acceleration and deceleration of the electric locomotive, would be slight. These observations are intended to apply more particularly to passenger services and to main lines which have not the characteristics of suburban traffic, and doubtless there are sections of main or important secondary lines, as, for instance, in Welsh colliery districts, where the gradients are in some cases comparatively steep and the distances between block sections short, and where, therefore, the greater hauling power and greater power of acceleration of the electric locomotive would appreciably affect the number of trains that could be run and indirectly the number of locomotives required; but, treating the subject comprehensively, it may be concluded that the advantages resulting from the electrification of suburban lines in thickly populated districts are largely absent in the case of through main lines.

It would appear, therefore, that the adoption of electric traction for main lines in this country must largely turn on the possibility of reducing working expenses to an extent sufficient to include a return on the cost of conversion and the increased cost of maintenance of the track, and under existing conditions in this country that result does not at present seem probable.

Legal.

The Construction of a Supply Agreement.

The Lancashire Electric Power Co. asked the Manchester Chancery Court, on October 28th, to determine the construction to be placed upon a clause in an agreement dated November 22nd, 1926, which fixed the terms upon which they supply electricity to the Rochdale Corporation. It was said that the clause provided that any disagreement about a revision should be referred to an arbitrator. The Corporation gave notice that it desired a revision of prices. The company contended that the price should be increased. The question had then been raised whether the arbitrator was to be restricted to considering the matter specified in the notice.

The Vice-Chancellor said that it was a commercial agreement, and must be construed in a business-like way. It was the arbitrator's duty to deal with the revision, and he was not restricted to what was specifically stated in the Corporation's notice.

Manchester Private Telephone and Electric Co., Ltd.

Judge Leigh, in the Manchester County Court on October 28th, made an order for the compulsory winding-up of this company. The petitioners were the National Bank, Ltd., creditors for £1,170. It was stated that the company had an authorised and paid-up, or credited as paid-up, capital of £5,000.

An Electric Hare Dispute.

The hearing was concluded in the King's Bench Division last week of an action brought by Mr. Ernest A. Coleman, Highbury Grove, Islington, N., against Mr. Alfred A. Roberts, Grosvenor Place, S.W.1., for damages for an alleged breach of an agreement to use an electric hare which could jump hurdles, wagged its tail, and squealed, and of which the plaintiff was the inventor.

Mr. Coleman's case was, that the company to be formed by Mr. Roberts was to pay him £2,000, and employ him as engineer and manager at £1,300 a year and 10 per cent of the net profits.

Mr. Roberts alleged that Mr. Coleman had concealed material facts from him when he signed the agreement and had made untrue representations.

The action was tried before Mr, Justice Hawke and a common jury, when the jury answered a number of questions in favour of the defendant. When the case was resumed, it was stated that in view of the answers of the jury in defendant's favour, Mr. Coleman did not further contest the matter, and judgment was accordingly entered for Mr. Roberts on the claim, with costs, and also judgment for him on his counterclaim that the agreement should be rescinded.

Extension of Western Electric Patents.

In the Chancery Division, on Monday last, Mr. Justice Luxmoore heard an application for the extension of time of certain patents which were registered in the name of the Western Electric Co., Ltd.

Mr. Trevor Watson said the application was made in respect of three patents of August 7th and September 6th, 1913, all of which had now expired. The application was made on behalf of Standard Telephones & Cables, Ltd., which was the Western Electric Co. under another name. The latter operated in Great Britain for a corporation in Chicago to exploit its inventions. The patents were for the improvement of long-distance telephony, but owing to the war the Post Office abandoned all constructional schemes, and the company became engaged on munition work, and thus lost the whole period of the war, not coming back to its usual work until 1919. There was no opposition to the application.

Mr. Stafford Crossman, for the Comptroller-General of Patents, said he did not object to an extension of four or five years.

His Lordship thereupon extended the patents from September, 1929, to August, 1934.

Triotone, Ltd.

Mr. Justice Romer in the Companies Winding-up Court last week, made an order for the compulsory liquidation of Triotone Ltd., dealers in radio and electric goods, on the petition of the Marconiphone, Co., Ltd.

It was stated that the petitioners' debt was about £88 as to which judgment was obtained last August and had not been satisfied. Nobody appeared for the respondent company.

Reviews.

Laboratory Notes for Electrical Engineering Students. By A. R. Nissar. Second Edition, 1927. Pp. 57. Calcutta: MacMillan & Co. Price 2 rupees.

This is a collection of 92 laboratory experiments printed on the left-hand side of quarto paper, the right-hand side being left blank for the student's use. They range from simple tests on galvanometers and cells to induction motor circle diagrams and tests on a Deri repulsion motor. No diagrams are given. It is impossible to recommend the book for use by the ordinary laboratory student in this country, although no doubt those responsible for planning out such courses might get some useful suggestions from it. Apparatus and equipment varies so much from place to place that a laboratory experiment, when outlined in sufficient detail for the student to perform it, is largely a local growth and rarely survives transplantation. In this case the author has avoided the difficulty by the simple expedient of leaving out most of the explanation, and the result in many cases is a bare list of commands and questions, such as "What is Ohm's law?" and "Expnt. XLVIII: calibrate a wattmeter." Moreover, the arrangement of sub-headings and divisions is extremely confusing, and items 2, 3, &c., may be found without any item. Finally, there are a number of misprints, some of which are definitely misleading. Thus on page 12 it states that "1 B.T.U.=1,055 watts." From the context this might be either a Board of Trade unit or a British thermal unit, but in either case it would be energy and could not equal power.

D. J. B.

Applied Geophysics in the Search for Minerals. By A. S. Eve and D. A. Keys. Pp. x+253; figs. 92. London: Cambridge University Press. Price 12s. 6d. net.

During the Great War physical science was applied to the solution of many problems of immediate importance. The position of aeroplanes and airships was determined at night by means of direction finders, while hidden guns were accurately located, even at a distance of several miles, by sound-ranging apparatus, in which the small change of electrical resistance of fine wires due to air waves resulting from distant gun-fire was measured. Methods of locating enemy submarines were also employed, in which the noise of the vessel, its electro-chemical properties, its magnetic effects, and the reflection of sound from its surface were all made use of. A highly successful echo-sounding method was also introduced to measure the depth of the ocean from a ship, even when travelling at speed.

Following the success of these applications of physical science, it was natural that similar methods should be developed for the location of mineral deposits and marked subterranean inequalities, which may be associated with occurences of economic importance.

In the introductory chapter of the book under review, the authors give a general indication of the scope and nature of this new science, now known as Applied Geophysics, and, in discussing some of the difficulties of the subject, offer a number of practical hints which the student will find of real value.

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Magnetic, electrical, electro-magnetic, gravitational, and seismic methods are each dealt with in a separate chapter, while a further chapter is devoted to a consideration of radio-active and other methods. The volume concludes with an excellent bibliography of leading books and articles sufficient for most investigators.

In each of the chapters the theory of the particular method under consideration is set out clearly and concisely, the field instruments are then described with due attention to the important practical features, after which field results actually obtained with the method are examined and discussed, while in some cases the interpretation is also considered. The authors have succeeded in producing a book which is undoubtedly a happy combination of theory and practice, embodying sufficient of each to ensure its appeal to all who are in any way interested in the subject. It is historical, and at the same time up-to-date, and, while setting forth the evolution of all branches of the subject, it also includes the latest information and developments that are at present available. Altogether it may be regarded as a well-balanced and authentic treatise, well suited to serve as a text-book of this very fascinating and rapidly developing science.

Private Automatic Branch Exchanges. By R. T. A. Dennison, Engineer-in-Chief's office, G.P.O., London. Pp. ix+291; figs. 99. London: Sir Isaac Pitman and Sons, Ltd. Price 12s. 6d. net.

This volume is the latest of a series of works on automatic telephony which have emanated, from time to time, from members of the Post Office Engineering Department, and hence may be regarded as authoritatively representing, in so far as private automatic branch exchanges are concerned, the systems approved of in this country by the Department.

The book is clearly not intended for beginners, but for those who already possess a knowledge of the general principles of automatic telephony. It has been specially written for telephone engineers, and deals in detail with private branch automatic telephony only.

The work is divided into nine chapters comprising: the Relay Automatic Telephone Co's 24-volt and 32-volt systems; the Standard Telephones and Cables system (British Post Office Unit Auto No. 4); the Automatic Telephone Manufacturing Co's system based upon the standard Strowger system of automatic switching, and Messrs. Siemens Bros. & Co.'s system based upon their No. 16 switching principles.

Although in a manual of this description it is probably unavoidable that at certain parts of the text the reader has to refer to diagrams which are either in advance of, or behind the page which he may happen to be reading, it nevertheless makes its perusal less easy than if the diagrams were in closer juxtaposition to the explanatory text. Apart from this, however, the work must be regarded not merely as a useful, but as a necessary, contribution to the literature of automatic telephony.

The descriptions of the various systems are concise and to the point, and the associated diagrams and insets are lettered and worded in the clearest possible way. These, it ought to be mentioned are printed with the permission of the engineer-in-chief of the General Post Office.

The book is exceedingly well printed, and in a size of type that will commend itself to the reader. A useful appendix on the relay nomenclature of the various systems is given at the end of the volume.

Speech and Hearing. By Harvey Fletcher. Pp. 331; figs. 151. London: Macmillan & Co., Ltd. 21s. net.

Dr. Harvey Fletcher, in his book on "Speech and Hearing," has revealed many new and interesting facts which revolutionise our theories with regard to the function of the human ear.

To arrive at these conclusions, an immense amount of research work has been necessary, but, as Dr. Harvey Fletcher has been director of acoustical research in the Bell Telephone Laboratories, Incorporated, he had had unlimited scope and resources for his work.

No aspect that would bring about a better understanding with regard to our mechanism of hearing has been overlooked, and the reader will find that contemporary discoveries in physiological and other branches of medical science have had a great bearing on the raising of our present standard of knowledge of the subject.

As a scientific work the book is of the highest standing, and, if any business man is in doubt as to the commercial value of launching a research into a purely scientific question, he could find no better answer than is given in its pages.

Charles M. R. Balbi.

Streatfield Memorial Lecture.

The Institute of Chemistry cordially invites old Finsbury students to hear the Streatfield Memorial Lecture on "The World's Sugar Industry," by Mr. Lewis Eynon, B.Sc., F.I.C., on November 22nd. Tickets can be obtained from the Hon. Sec., Finsbury Old Students' Association, F. R. C. Rouse, 15, Clifton Gardens, Golders Green, N.W.11.

Parliamentary News.

[By Our Special Parliamentary Correspondent.]

Parliament reassembled for the Autumn Session on Tuesday, October 29th.

Finsbury Park Tube.

On October 30th, Mr. H. Morrison informed Mr. R. Morrison that the Committee appointed under Part I of the Development (Loan Guarantees and Grants) Act had received an application for assistance in connection with various schemes, which include a proposed railway running northwards from Finsbury Park.

The Government's Employment Plans.

On November 4th, Mr. Thomas, the Lord Privy Seal, outlined the Government's plans for dealing with unemployment. The Unemployment Grants Committee, he said, in the last three months had approved relief schemes amounting to £11,000,000, and a further £10,000,000 worth were under consideration. The Duckham Committee had approved railway schemes, amounting to £7,000,000, divided between the G.W., the L.M.S., and the Metropolitan Railways. The L.M.S. programme included electrification schemes in the Wirral peninsula, and the electrification of the line between Dagenham and Upminster. The Underground Group had submitted a scheme involving £13,000,000 of expenditure, and that was now under consideration. It included the extension of the Piccadilly Tube from Finsbury Park to Cock Fosters, and from Hammersmith to Northfields, and the improvement of stations in the inner area to facilitate dealing with extra traffic. 13,000 tons of steel sleepers had been ordered in this country by the railway companies. The Electricity Commission had been asked to "speed up" its programme. Schemes covering nearly half the country, and three-quarters of the population, now existed, and the Central Electricity Board had let contracts amounting to £1,250,000 since last July. The Post Office had also accelerated its programme, and was spending £750,000 this year, and a similar sum next year on telephone extension. He also outlined a scheme of road development costing £9,500,000 spread over four or five years, and a further five-year programme to cost £28,000,000.

The Committee on Finance and Industry.

In the House of Commons on Monday last the Chancellor of the Exchequer announced the personnel of the Committee which he has appointed with the following terms of reference: "To inquire into banking, finance and credit, having regard to the factors, internal and international, which govern their operation, and to make recommendations calculated to enable these agents to promote the development of trade and commerce and the employment of labour." The chairman is the Right Hon. H. P. Macmillan, K.C., and the members are: Sir Thomas Allen, Mr. E. Bevin, Lord Bradbury, the Hon. R. H. Brand, Professor T. E. G. Gregory, Mr. J. M. Keynes, Mr. Lennox B. Lee, Mr. C. Lubbock, the Right Hon. R. McKenna, P.C., Mr. J. T. W. Newbold, Sir Walter Raine, Mr. J. Frater Taylor, and Mr. A. A. G. Tulloch.

Correspondence.

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession.

Cross Field of Single-phase Motors.

An interesting "snag" has presented itself, to which as yet I have been unable to find any reference in text-books. Not being capable myself of solving the problem, perhaps some of your readers will be good enough to help me.

Most text-books, when dealing with the cross-field theory of the single-phase induction motor, inform us that the stator winding produces a magnetic field (Ft) lagging 90 deg. behind the terminal e.m.f., thus inducing a back e.m.f. in a similar manner to a transformer. The conductors in the rotor, when revolving, have an e.m.f. (Er) impressed upon them, due to and in phase with Ft. Any current flowing as a result of Er will produce a magnetic field, called the cross-field, or speed-field (Fc) displaced 90 deg. in space to Ft. This position in space places the cross-field in an open circuited condition, and therefore the current in the rotor set up by Er must lag 90 deg. to produce the necessary back e.m.f. to Er. We thus obtain two magnetic fields (Ft and Fc), varying in space and time by 90 deg.

The foregoing appears quite clear until we bear in mind that the rotor is revolving, and therefore any rotor conductor having maximum e.m.f. impressed upon it by cutting Ft must have moved nearly 90 deg. in space (*i.e.*, quarter of a revolution in a two-pole motor) before the magnetising current, which is lagging 90 deg. in time, has reached its maximum. It would appear that the magnetic field set up by the rotor

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is not a cross-field, but one in the same space phase as the stator field.

Carrying this theory further, one comes to the conclusion that the current flowing because of the difference in time phase (produced by the rotor resistance and reluctance of cross-field) between the e.m.f. in the rotor due to the transformer action of the stator magnetic field and the e.m.f. due to cutting the cross-field is responsible for the cross-field.

Eee Bee.

October 28th, 1929.

Personal Salesmanship.

With reference to the disappointing lecture which was given by Miss Burlton, and the great interest that is now shown in such lectures, may I voice through your columns a suggestion that was made after this meeting, *viz.*, that a lecture should be given on showroom service by someone who has had practical experience in electrical showrooms. The E.D.A. might approach the Fittings Section of the B.E.A.M.A. to provide the lecturer.

Showrooms.

October 28th, 1929.

Lord Meston on the Calcutta Tube.

In your last issue there appears an interesting description of a project for a tube railway in Calcutta. In the course of it your Indian correspondent remarks that "electrical energy cannot be purchased in Calcutta." He must have been writing under some misapprehension, because the Calcutta Electric Supply Corporation has been in the field for many years, and is able to supply all the electrical energy which the projected railway is likely to require. The company has two large generating stations with an aggregate amount of generating plant rated at over 100,000 kilowatts. In the year 1928 it sold 148,000,000 units; so that there is obviously a wide margin available for future customers. Those who are familiar with the rates at which the company supplies the large industrial concerns in and around Calcutta will appreciate that its terms need not be less favourable than those which could be offered by an *ad hoc* power station.

Meston.

Strand, W.C.2.
October 30th 1929.

Bowl Fires.

The ordinary bowl fire is liable to tarnish when its reflecting power diminishes. Now that chromium is being used on a large scale for motor-car plating, there seems to be no reason why it should not be used for bowl fires. My experience with the Ferranti fire shows that chromium plating increases the efficiency enormously, as it directs the heat horizontally instead of wasting it in air heating. Perhaps the makers of bowl fires will produce a chromium-plated bowl, which will greatly increase the popularity of this useful appliance.

Chromium.

October 23rd, 1929.

[Is heat wasted when it warms the air?—EDS. ELEC. REV.]

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken

1928.

10,675. "Electrical indicating, measuring, recording, or controlling apparatus." H. E. Dance. April 11th, 1928. (Cognate applications, 22,239/28 and 25,887/29.) (320,364.)

11,036. "Electrolytic apparatus." A. E. Knowles. April 14th, 1928. (320,388.)

11,273. "Sound amplifiers for wireless loud speakers and the like." G. G. de Andia-Ycarrazaval. April 17th, 1928. (320,214.)

13,735. "Electric heating elements." B. Thomas and E. Thomas. May 10th, 1928. (320,352.)

16,268. "Automatic telephone systems." G A. Betulander. July 10th, 1928. (320,366.)

16,569. "Electric circuit-interrupting systems and methods of controlling said electric circuits." G. A. Burnham. June 7th, 1928. (320,337.)

16,697. "Toroidal coil windings." P. R. Coursey and Dubilier Condenser Co. (1925), Ltd. June 8th, 1928. (320,319.)

16,739. "Electric circuit breakers." E. B. Wedmore, W. B. Whitney, and British Electrical and Allied Industries Research Association. June 8th, 1928. (320,320.)

16,760. "Electric supply service boxes or fittings." C. W. Cox and C. E. C. Shawfield. June 9th, 1928. (320,356.)

16,804. "Pneumatic devices for making and breaking electrical circuits." M. Bergoin. June 11th, 1927. (292,078.)

16,906. "Electrical testing sets." W. Holmes and Ferranti, Ltd. June 9th, 1928. (320,338.)

16,981. "Electric couplings." J. A. Crabtree and B. G. Harrison. June 12th, 1928. (320,390.)

19,158. "Means for starting and stopping an electrically-driven talking machine." G. Schonstein. July 2nd, 1928. (320,322.)

19,290. "Amplifier volume control for carrier signalling." Hazeltine Corporation. July 7th, 1927. (293,462.)

19,408. "Electrical insulating materials." W. S. Smith, H. J. Garnett, J. N. Dean, B. J. Habgood, and H. C. Channon. July 4th, 1928 (Cognate application, 10,016/29.) (320,370.)

19,848. "Manufacturing cathodes for thermionic valves." Dr. S. Loewe. July 9th, 1927. (293,694.)

19,887. "Telephone systems." Siemens Bros. & Co., Ltd., and D. A. Christian. July 9th, 1928. (Addition to 292,331.) (320,348.)

19,946. "Electric discharge tubes." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). July 9th, 1928. (320,398.)

20,147. "Automatic or semi-automatic telephone systems." Standard Telephones & Cables, Ltd., and E. P. G. Wright. July 11th, 1928. (320,380.)

20,167. "Electric protective systems." A. Reyrolle & Co., Ltd., and H. C. Atkins. July 11th, 1928. (320,383.)

20,502. "Electrical condensers." P. R. Coursey and Dubilier Condenser Co. (1925), Ltd. July 12th, 1928. (320,405.)

20,416. "Film-driving mechanism for sound-recording or reproducing apparatus." British Thomson-Houston Co., Ltd. August 12th, 1927. (295,379.)

20,737. "Aerials for use in wireless-telegrapny and telephony." C. S. Franklin and E. Green. July 17th, 1928. (320,425.)

21,088. "Pluge for electrically-heated apparatus." International General Electric Co., Inc. July 21st, 1927. (294,256.)

21,313. "Apparatus for recording and reproducing sound." A. J. Stephens (H. T. Leeming). July 23rd, 1928. (320,431.)

21,994. "Electric switches of the tumbler type." J. A. Crabtree. July 30th, 1928. (320,442.)

22,167. "Wireless receiving apparatus." D. Montague and S. Montague. July 31st, 1928. (320,443.)

22,404. "Electric distributing systems, with duplicate bus-bars." Siemens-Schuckertwerke Akt. Ges. August 12th, 1927. (295,386.)

23,615. "Electric power plant for running in fluid-pressure engines." General Electric Co., Ltd., N. M. Hill, and W. Wilson. August 16th, 1928. (320,465.)

23,996. "Wireless valve holders, coil holders, and the like." A. H. Whiteley. August 21st, 1928. (320,460.)

26,203. "Electric switching systems controlled by timing apparatus." E. Boder. February 10th, 1928. (305,644.)

27,270. "Means for controlling electrical fault-indicating and protective devices." Siemens Schuckertwerke Akt Ges. October 25th, 1927. (Addition to 297,734.) (299,330.)

27,407. "Means for controlling electrical fault-indicating and protective devices." Siemens-Schuckertwerke Akt. Ges. March 12th, 1928. (Addition to 297,734 and 299,330.) (307,735.)

27,892. "Elevator system." Waygood-Otis, Ltd. September 28th, 1927. (297,801.)

27,900. "Electric illuminated advertising and display devices." C. W. Denny. September 28th, 1928. (Cognate application, 33,846/28.) (320,511.)

28,159. "Sound-reproducing devices." A. H. H. Corell. October 2nd, 1928. (320,515.)

29,299. "Method of, and apparatus for, X-ray investigation." Siemens-Reiniger-Veifa Ges. für Med. Technik. November 28th, 1927. (301,377.)

29,785. "Electrolyte for galvanic elements or cells." G. Hanekop and W. Schmidt. October 15th, 1928. (320,526.)

30,420. "Connecting means for electric conductors of aluminium or aluminium alloy." Siemens-Schuckertwerke Akt. Ges. October 22nd, 1927. (299,314.)

31,400. "Method of, and apparatus for, taking X-ray photographs with a short exposure." A. E. O'dell (Siemens-Reiniger-Veifa Ges für Medizinisch Technik). October 29th, 1928. (320,540.)

32,011. "Protecting carbon electrodes from consumption in the atmosphere." I. G. Farbenindustrie Akt. Ges. December 23rd, 1927. (302,891.)

32,659. "Automobile and like lanterns." I. N. S. Frydenlund. November 8th, 1928. (320,545.)

32,792. "Quick-acting switches for heavy currents." Siemens-Schuckertwerke Akt. Ges. November 17th, 1927. (Addition to 299,461.) (300,647.)

33,320. "Holder for electric lamps for use in projection apparatus." L. F. Gardner (Bing Werke vorm. Ges. Bing Akt. Ges.). November 14th, 1928. (320,551.)

33,924. "Electric cables." Felten & Guilleaume Carlswerk Akt. Ges. November 19th, 1927. (300,920.)

34,535. "Electric fires or radiators." H. H. Berry. November 23rd, 1928. (Cognate application, 5,527/29.) (320,555.)

34,974. "Electric cables." Felten & Guilleaume Carlswerk Akt. Ges. January 12th, 1928. (Addition to 300,920.) (303,881.)

35,491. "Dynamo-electric machines." F. G. Baum. December 1st, 1928. (320,563.)

35,770. "Induction-type electricity meters." Associated Electrical Industries, Ltd. December 9th, 1927. (301,915.)

36,974. "Electric insulators" Akt. Ges Brown Boveri et Cie. May 9th, 1928. (311,313.)

1929.

2,797. "Globe-supporting galleries of electric and gas-lighting fittings." Maxlume Lighting and Heating Co., Ltd., and F. W. Thorpe. January 28th, 1929. (320,588.)

5,348. "Vehicle headlights." R. H. Angot. February 18th, 1928. (306,462.)

7,192. "Electric remote-control systems." Associated Telephone and Telegraph Co. August 3rd, 1927. (Divided application on 294,980.) (307,358.)

8,100. "Electrodes for electric arc welding or soldering." Alloy Welding Processes, Ltd. March 12th, 1928. (307,760.)

8,214. "Electrodes for electric arc welding or soldering." Alloy Welding Processes, Ltd., and E. J. Clarke. March 13th, 1929. (320,596.)

25,755. "Braking of electric winches or the like lifting and lowering apparatus." W. H. Scott, G. J. Scott, and H. D. Wheeler. July 4th, 1928. (Divided application on 319,429.) (320,330.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from October 30th :—

D.C. (lettering and design). No. 504,121. Class 8. Electric cables.—Derby Electric Cables, Ltd., Alfreton Road, Derby.

Pam. No. 505,170. Class 8. Thermionic valve amplifiers.—Claude Lyons, Ltd., 76, Old Hall Street, Liverpool.

B.S.R., Selhurst Radio (lettering and design). No. 505,321. Class 8. Radio-telephonic loud speakers, transformers and component parts.—A. Baker, trading as Baker's Selhurst Radio, 89, Selhurst Road, South Norwood, S.E.25.

Orgola. No. 505,267. Class 8. Instruments and apparatus for radio signalling, thermionic valves, thermionic amplifiers, &c.—Mullard Radio Valve Co., Ltd., 45, Nightingale Lane, S.W.12.

Viking. No. 502,909. Class 13. Electric lamps for cycles.—L. K. Loft, 525, Canterbury Street, Gillingham, Kent.

Mep. No. 506,327. Class 13. Electric headlamps for use on motor vehicles, motor cycles, bicycles, &c.—M. E. Power, 41, Queensborough Terrace, Hyde Park, W.2.

Normal. No. 503,557. Class 16. Insulators of porcelain for use with electric wires.—Naamlooze Vennootschap Ramle Union, Enschede, Holland. (British representative: J. Martin Blair, Audrey House, Ely Place, E.C.1.)

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New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERDEEN.—School (800 places), for the Education Authority; the master of works.

AUDENSHAW.—Secondary school (£34,000); director of education, County Offices, Preston.

AYR.—County buildings (£100,000); A. Mair, architect, Wellington Square.

BLYTH.—Houses, Morpeth Road (100), and South Farm (22); borough engineer.

BRIGHTON.—Extensions, Rottingdean School; Shepherd and Maxwell. Home for children, Brighton Road, Rottingdean; Old Roedeanians' Association.

BROMLEY (Kent).—Extensions, Locks Bottom Hospital, for the Board of Guardians; F. Danby Smith, architect, Parliament Mansions, Victoria Street, S.W.1 (returnable deposit of £5).

CARLISLE.—Houses (250), Corporation estates; city engineer. Extensions, Botchergate, for Carlisle Picture House, Ltd.; G. Gunn, architect.

CHELTENHAM.—Motor coach station, Rodney Road, for Black and White Motorways, Ltd.; Mr. Yates.

COVENTRY.—Library, Longford; city engineer.

CROMARTY.—School (£50,000), for Ross and Cromarty Education Authority; master of works, Education Authority, Dingwall.

CROOKHAM.—School (320 places), for the Hampshire E.C.

CROYDON.—Additions, St. Mary's Maternity Hospital (£13,250); governors. Extensions, infirmary, Mayday Road; borough engineer.

EASTBOURNE.—Hotel, Victoria Drive, for People's Refreshment House Association, Ltd.; P. D. Stoneham and Son, architects. Bank and offices, Terminus Road, for National Provincial Bank, Ltd.; Palmer & Stoneham, architects.

FINDOCHTY, N.B.—Harbour extension (£22,000); Harbour Board.

GILLINGHAM (Kent).—Station extensions (£35,348), for the Southern Railway Co.; engineer.

GLASGOW.—Buildings at Stobhill Hospital (£13,887), for Parish Council; the clerk.

GUILDFORD.—Building estate, Manor Road; W. & J. Spooner.

HARROGATE.—Secondary school, Otley Road; education officer, County Hall, Wakefield.

HAYES.—School (650 places), and extensions at Townfield school; Middlesex E.C. Houses (104), Hayes Gate estate; R. T. Warren, architect.

HOUNSLOW.—Houses (40), Heston Hall estate; Perry's (Ealing), Ltd.

HULL.—Electric lighting installation and blower for organ, St. Nicholas Church; vicar.

IRISH FREE STATE (Maryborough, Queen's Co.).—Schools at the Presentation Convent; Vincent Kelly, architect, 87, Merrion Square South, Dublin (returnable deposit of £5 5s.).

KINGSBURY.—School (400 places); Middlesex E.C.

LANCS.—Schools (18), for Lancs. E.C.; director of education, Preston.

LEICESTER.—Adapting library, Belvoir Street, as municipal offices. Swimming and Turkish baths (£60,000); city engineer. Waterworks (£254,000); water engineer. Telephone exchange, Westcotes; H.M. Office of Works.

LIVERPOOL.—Secondary school, Wavertree; director of education, Education Offices, Sir Thomas Street.

LONDON (Whitechapel, E.).—Reconstruction of fire station (£16,359); L. H. & R. Roberts

(Stamford Hill, N.).—Extension, stores depôt (£11,540); Albert Monk.

(Lambeth, S.E.).—Buildings, Albert Embankment, Salamanca Street, and Broad Street; Imrie & Angell. Extension, Brixton Town Hall; Special B.C. Committee. Education library, County Hall (£25,000); L.C.C. architect.

LONDON (*continued*).

(Woolwich, S.E.).—School, Henwick Street (£29,914); W. H. Gaze & Sons, Ltd., Kingston.

(Brixton, S.W.).—Buildings, 233-9, Brixton Road; H. M. Wakley.

(Clapham, S.W.).—Development, building estate, Wilcox Road, Wandsworth Road, and Hartington Road, for Ecclesiastical Commissioners; Messrs. Cluttons.

(Streatham, S.W.).—School, Streatham Vale (£29,887); G. H. Denne & Son, Ltd., Holborn. Church, Streatham Vale (£25,000); secretary, Clapham Sect. Memorial Committee.

(Victoria, S.W.).—Buildings, for D. G. Somerville & Co., Ltd., 104-112, Buckingham Palace Road; R. N. Stroyer.

(Bloomsbury, W.C.).—New block, Bedford College for Women (£18,000); governors and London University. Offices and stores, for the L.C.C., at the old factory, North Street; L.C.C. architect.

LUTON.—School, Chaul End, for the Beds. E.C.; director of education, Bedford. Bleaching factory, for Barford Bros., Ltd.; works extensions, including laboratory, for Alcock (Peroxide), Ltd.

LYTHAM ST. ANNES.—Reconstruction of hospital (£27,000); for the committee; secretary.

MANCHESTER.—Erection, Barlow Hall school; E. J. Bentley & Son, quantity surveyors. Schools at Chorlton and Newton Heath; clinic adjoining Royal Infirmary (£30,000); city architect. Extension of Midland Hotel, L.M. & S. Railway (Hotels Department).

MARTON-LE-MOOR (Yorks.).—Electric lighting installation, Parish Church; vicar.

MELTON MOWBRAY.—Boys' and girls' senior schools and junior school, for Leicestershire E.C.; director of education, Leicester.

MIDDLETON-IN-TEESDALE. — Re-erection of stores (£20,000), for the Co-operative Society; secretary.

MINEHEAD (Somerset).—Housing scheme (35), for the U.D.C.; surveyor.

MOTHERWELL.—Extensions, post office and telephone exchange; architect, H.M. Office of Works, 123, George Street, Edinburgh (returnable deposit of £1 1s.).

NEWTON-IN-MAKERFIELD.—Practical instruction centre; director of education, County Education Offices.

OLDHAM.—Library; Libraries Committee.

ORMSKIRK.—New training college (£200,000); director of education, County Education Offices, Preston.

PAULTON (Bristol).—Hospital extensions; H. J. Emm, hon. secretary.

PRESTON.—Two housing schemes (119 and 109) (deposit £1 each); borough engineer, Town Hall.

QUARRY BANK.—Housing scheme (42), for the U.D.C.; Alfred Homfray, clerk (returnable deposit of £2 2s.).

SCARBOROUGH.—Additional 54 houses, for the T.C.; borough surveyor.

SELBY (Yorks.).—Electric lighting installation, The Abbey; vicar.

SHIPLEY.—Houses (80); U.D.C. surveyor.

SKEGNESS.—Development scheme, including large pavilion (£22,767), for the U.D.C.; R. H. Jenkins, surveyor.

SMETHWICK.—Houses, Brisbane Road (38), and Hamilton Road (12); borough engineer. School (£57,000); F. H. Smith, builder, Birmingham. Town hall, Victoria Park; law courts, Crocketts Road (£15,000); borough engineer. Cinema, Windmill Lane; B. Burleigh, 54, Bristol Road, Birmingham.

SOUTHALL (Middx.).—Hall, for Wesleyan authorities (£10,000); A. & B. Hanson, Ltd., The Green, Southall, builders.

STOKESLEY (Yorks.).—Electric lighting installation, Parish Church; vicar.

TAUNTON.—Housing scheme (54), for the T.C.; F. Shellard, borough engineer (returnable deposit of £2 2s.).

TYNEMOUTH.—Waterworks (£123,000); water engineer. Baths and wash-houses, Churchway; borough engineer.

WESTON-SUPER-MARE.—Factory, Langford Road, for the H. S. P. Wireless Co.

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The ELECTRICAL REVIEW

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M.E.M. *See page xi.*

Advertisement Index, see page xliv. *Official Notices, see Sup. 36.*

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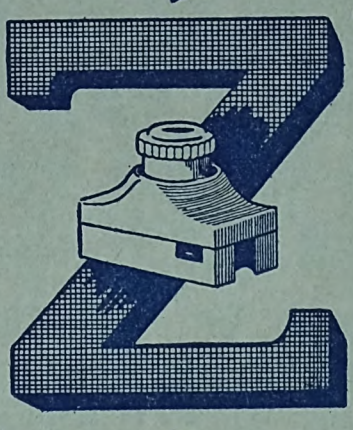

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TABLE of DOMESTIC TARIFFS.

Particulars of Undertakings supplying energy for

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·5d (or less) per kWh.

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Undertaking.	Engineer.	Total M.D. on system, K.W.	Primary charge basis, per annum. R.V. = Rateable Value.	
Aberdeen Corporation	J. Alex. Bell.	15,700	12½% R.V.	
Ashton-under-Lyne Corp'n	N. Appelbee.	6,239	15% R.V. (Min. £15)	
Barnes U.D.C.	C. S. Davidson.	5,050	7½% R.V.	
Beckenham U.D.C.	J. E. Tapper.	3,124	8% R.V.	
Bolton Corporation	H. E. Annett.	30,800	4½d. per kWh, less 2½% for defined no. of kWh per room	
Bradford Corporation	Thos. Roles.	41,000	8¾% R.V.	
Clyde Valley Elec. Power Co.	E. T. Goslin.	—	£1 per assessed room	
Darlington Corporation	J. R. P. Lunn.	10,650	None	
Eastbourne Corporation	J. K. Brydges.	8,015	7½% R.V.	
Glasgow Corporation	H. Bell, (General Manager).	106,900	10% R.V.	
Gloucester Corporation	F. H. Corson.	3,600	20% R.V.	
Greenock Corporation	D. McDougall.	14,156	Based on No. of rooms	
Hull Corporation	J. N. Waite.	29,900	15% R.V.	
Ipswich Corporation	A. S. Black.	9,950	20% R.V.	
Hackney Met. Borough	L. L. Robinson.	21,280	—	
Kensington and Knightsbridge E. L. Co., Ltd.	G. S. Britton, (Manager). G. C. Weston, (Engineer).	7,560	—	
Leeds Corporation	C. N. Hefford.	58,000	15% & 10% R.V.	
Liverpool Corporation	P. J. Robinson.	93,700	5% R.V. and 2½% above £30	
Maidstone Corporation	E. E. Hoadley.	7,800	7s. per 30-W lamp	
Manchester Corporation	H. C. Lamb.	156,370	20% R.V. of 1914	
Nelson Corporation	G. F. Nayler.	4,600	20% R.V.	
N. Metropolitan E. P. S. Co.	Capt. J. M. Donaldson.	—	Floor area and lighting wattage	
Oldham Corporation	F. L. Ogden.	24,400	20% R.V. (Min. £10)	
Preston Corporation	J. F. Simpson.	21,000	15% R.V. (5% above £40)	
Rochdale Corporation	F. H. Rudd.	31,194	15% R.V.	
St. Helens Corporation	W. S. Johnston.	9,600	20% R.V.	
St. Marylebone Met. Borough	C. H. Smyth.	53,751	£9 5s. to £14 per kW installed	
St. Pancras Met. Borough	J. T. Baron.	22,400	£16 per kW of assessed lamps	
Sheffield Corporation	E. Morgan.	80,520	1½ R.V.	
Southport Corporation	E. Moxon.	7,080	10s. per assessed room	
Stalybridge Ty. and Elec Board	J. H. Lumsden.	17,100	20% R.V.	
Stockton-on-Tees Corporation	S. G. Marston.	3,310	7s. per 100 sq. ft. of floor area	
Stoke-on-Trent Corporation	C. H. Yeaman.	13,050	£1 per assessed room	
Tunbridge Wells Corporation	R. N. Torpy.	5,600	10% R.V. or 22s. 6d. per living room 7s. 6d. per bedroom	
Wigan Corporation	R. Owen.	5,700	20% R.V.	
Wimbledon Corporation	A. E. McKenzie.	13,050	None	
Worcester Corporation	C. M. Shaw.	6,750	18% R.V.	
York Corporation	E. J. Nichols.	9,813	12½% R.V.	

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5d (OR LESS) PER kWh.

ndary charge. te per kWh.	kWh per head per annum. All consumers.	kWh per head per annum. Residential consumers only.	Price of gas. Pence per therm.	Percentage of wired houses to total houses in area.	Hire or hire-purchase of apparatus or assisted wiring schemes in force. H = Hire. H-p = Hire-purchase. AW = Assisted wiring. RW = Rental wiring.
0.5	202	—	4.0—5.4	19	H and AW
0.5	212	—	8.4	—	H (cookers only)
.5 Summer, ght water-heating	210	170	9.4	83.5	H, H-p and AW
ht water-heating	135	—	9.0	68	do.
kWh in excess of ed no. of kWh.	367	—	5.2—9.6	26	H-p and AW
10 kWh per £1 R.V.	66	—	9.0	24.3	H, H-p and AW
0.5	—	—	—	—	do.
summer months, 0.375 night	—	—	—	—	H and H-p in force, AW contemplated
0.5	205	—	9.0	80	H and AW
0.5	233	762	8.94	19	H-p
.5 Summer	100	—	9.67	—	Under preparation
ght water heating	168	—	7.75	28	H, H-p and AW
0.5	—	—	7.0	20	H & H-p of cookers and kettles. AW
0.5	184	—	9.0	30	H-p and RW
water heating	—	—	—	—	H and H-p
eak water heating	—	—	8.6	—	H, H-p and AW
0.5	280	1,600	9.57	50	H, H-p and AW
3 water heating 00 kWh per qtr.	—	—	7.4	—	H, H-p and AW
.5 Summer	527	—	9.2	33	do.
0.5	355	—	8.67—10.0	20	H, H-p and AW
240 kWh per qtr.	—	—	—	—	H-p
5 Summer	430/2,454	1,629/6,037	4.5—16	90 max.	H-p
0.5	—	—	7.0—8.0	—	H, H-p and AW
500 kWh per qtr.	191	1,446	9.25	25	do.
0.5	—	—	9.5	34	do.
0.5	301	—	6.53—7.79	—	H and H-p
0.5	653	—	8.6	86	H, H-p and AW
0.5	165	—	8.6	—	H, RW (lighting)
0.5	—	—	7.0	—	H and AW
0.5	—	—	8.93	—	H, H-p and AW
240 kWh per qtr.	—	—	7.8—8.8	—	AW
240 kWh per qtr.	106	—	6.8—8.0	—	H, H-p and AW
240 kWh per qtr.	—	—	—	—	do.
0.5					
0.5	148	—	9.0	32	do.
0.5	12	1,132	8.75	19	H
mmer, 0.5 water (cont.) 0.5 (night)	225	829	8.6—10.45	73	H, H-p and RW
0.45	259	—	7.0	25	H-p (including wiring)
0.5	300	—	7.12	44	H-p and AW

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The Point Five Domestic Rate.

IT is now rather more than 17 years since the formation of the "Point Fives." As to their aims we may, for the benefit of the post-war generation, quote from the report of the Society's first meeting as given in the ELECTRICAL REVIEW of July 19th, 1912—"it was unanimously held that it was desirable and quite possible for a differential rate to be evolved with a universal secondary charge per unit of .5d. or lower, and a primary charge varying in accordance with the locality, the costs of production of each particular undertaking and the nature of the service required by the consumer."

As a special supplement to the present issue, a list is enclosed of undertakings which include in their domestic tariffs a charge of one half-penny or less per kWh. In some cases a higher rate operates for a small number of kWh before the half-penny rate comes into force; in many cases alternative tariffs are offered in which the secondary charge exceeds that figure, but such alternative tariffs have been excluded. For completeness, the bases of the fixed charges made in most cases are added, although these are of relative unimportance for the present purpose, since it is a low secondary charge that encourages long-hour consumption. These particulars have not, in our knowledge, been previously published in this form and will, we believe, be of interest to electricity supply authorities and to manufacturers of electrical apparatus as an indication of what is being done in domestic electrification. Many other undertakings have devised interesting methods of charging which fall just beyond the scope of the present inquiry, and it is to be hoped that the Electricity Commissioners may later find it possible to include similar data on an extended scale in their valued statistical publications.

It will be appreciated that the particulars required are not always obtainable in the form adopted for the present inquiry, and that undertakings covering wide areas (*e.g.*, the North Metropolitan Electric Power Supply Co.) present difficulties in the way of a concise summary. Also it is possible that some undertakings whose rates entitle them to inclusion have been inadvertently omitted, and we should be glad to rectify any such omissions at a later date.

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We take this opportunity of thanking the chief engineers and managers of the undertakings mentioned in our list for their co-operation in its production.

One half-penny per kWh is a figure that compares favourably with the equivalent net cost of gas in most areas and of coal also, except for long-hour heating. Although the price is competitive, it is still high enough to make it necessary to stress the great importance of the incidental advantages of electricity. Long-hour heating, especially where economic means do not permit labour to be saved or dirt to be avoided, awaits development under still lower charges. Further, electricity has a future in raising the standard of living by encouraging a more liberal use of the prime necessities, such as warmth in rooms and plentiful supplies of hot water.

It will be noticed that the undertakings mentioned in our list have reinforced the appeal of low tariffs by arrangements for the hire or hire-purchase of apparatus, and assisted wiring. Such arrangements are now generally regarded as an essential part of any serious attempt to build up a domestic load.

The returns of the Electricity Commissioners show some relationship to exist between generating costs and the size of the station; our list shows that a similar relationship does not necessarily exist between tariffs and the size of the undertaking. It is, in fact, gratifying to note that some of the smaller authorities can profitably supply energy at the lowest rates, and it may be taken that their example will be followed sooner or later by those with larger systems. The honour of quoting the lowest rate for a supply for any purpose falls to Stoke-on-Trent with 0.375d. per kWh, after 240 kWh have been consumed in any quarter, Liverpool offers 0.3d. for water heating after 500 kWh per quarter, and Barnes and Wimbledon 0.33d. per kWh for night water heating.

In concluding, we may recall the view expressed in our editorial columns on November 1st, 1912:—"The engineer who adopts the ½d. rate risks far less than other people suppose, and plays for far greater stakes than he is himself aware of."

British and American Electrical Exports.

It is not very pleasing to observe that while British exports of electrical machinery and apparatus remain on about the same level month by month, American exports are increasing rapidly. Thus during the first eight months of this year the United States electrical export trade was valued at $95,548,733, against $71,909,794 in the corresponding period of 1928. British electrical exports in the same period rose only from £12,224,838 to £12,739,658. In comparing the actual totals it should be noted that the American figures include items which are not embodied in the electrical section of our Board of Trade returns. Again, while our imports of electrical equipment have shown a remarkable increase this year, American electrical imports have remained very low.

Taking August last as a fairly typical month it is found that over half of the American exports went to the British Empire markets (United Kingdom $651,170, Canada $4,113,160, India $113,003, Australia $593,195, New Zealand $183,984 and South Africa $227,249). On the face of things it would appear that trade to the extent of many millions sterling per annum which should come to the British electrical industry is going to the United States. While this is proceeding we continue to discuss the provision of work for the workless, but their number does not materially fall. Manufacturers and salesmen place prominently in their list of essentials greater concentration upon export trade progress if we are to secure industrial prosperity and more employment. They hold that more effective salesmanship activity and advertising plans, appropriate to the markets that ought to be secured by particular trades, are things that must be energetically employed if our export trade is to receive the desired fillip. Big contracts are being secured for Home operations, and companies are rearranging their affairs for making a good stand against foreign competition. It may be that there is little reason for regret in the condition of the British electrical industry as a whole, but the figures given above show, as we have said, how much trade we are missing that we should be securing, thus substantially increasing the output of British electrical factories and the employment of British bread-winners.

Fifty Electrical Years.

It is the duty each year for the chairman of the Council of the Royal Society of Arts to address the members at the first meeting of the session, and it is not unnatural that on becoming its chairman Mr. Llewelyn B. Atkinson should have devoted his inaugural address to a survey of the fifty years since the birth of the modern electric era and its growth during that period, since it so happens that he has been a personal witness of that growth.

It was an enormous subject to review in an hour and a half, but Mr. Atkinson is an attractive speaker and even by those who are already acquainted with the history of the electrical industry generally he was followed with close interest.

The ground covered by the address is, to a large extent, necessarily dealt with in existing publications, but many people will find the address useful, if only for the fact that it gives in tabloid form what otherwise involves a vast amount of research and reading to ascertain. In his usual thorough manner, Mr. Atkinson briefly detailed what has taken place since the days of Gilbert; he even went 2,500 years back when Thalen first observed the attraction of particles of straw by amber when the latter was rubbed with silk down to the present time in connection with electricity supply, telephony, telegraphy, and wireless telegraphy, and also entered upon a discussion of the progress of electric theory. Both the technical and the commercial aspects of the development of electricity were reviewed, and the events which led up to the appointment of the Electricity Commissioners and the Central Electricity Board were set out.

In a few words concerning the probable future, the chairman said that approximately during the last 25 years the consumption of electricity produced by local authorities had doubled every six years. The rate was, if anything, increasing, but the experience of other countries suggested that the point of saturation was a good way off. The electrification of main-line railways had not yet commenced, for example, and they might look forward, say, for 20 years to a period of great activity, both in the science and industrial applications of electricity.

As a record of the march of events the address stands out as a condensed history of electrical science and industry the like of which does not exist elsewhere, and to an audience of a more or less popular nature, as are so many audiences at the Royal Society of Arts, the story proved a fascinating one. It was fitting, too, that such an old pioneering veteran of the industry as Col. R. E. Crompton should have proposed a vote of thanks to Mr. Atkinson, for they both have a fund of reminiscences of the early days of electricity supply and the development of electrical science generally, much of which would prove even more interesting than a statement of fact, such as the address was. As the number of those who, like Mr. Atkinson, have lived through the period of growth outlined is sadly diminishing, his *résumé*, with stress on the critical points of progress, may be of some use to those who will follow.

Our 57th Birthday.

It may interest our readers to know that to-day, Friday, November 15th, 1929, we celebrate our fifty-seventh birthday, the first number of the *Telegraphic Journal and Monthly Illustrated Review of Electrical Science* having appeared on November 15th, 1872. The title was shortened to "*The Telegraphic Journal and Electrical Review*" two months later.

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The I.E.E. Portraits.

Two Additions to the Series which Adorns the Lecture Theatre Walls.

APART from a collection of framed photographs and one or two paintings of its past-presidents, the Institution of Electrical Engineers did not until quite recently possess painted portraits of any of the distinguished electricians it has numbered amongst

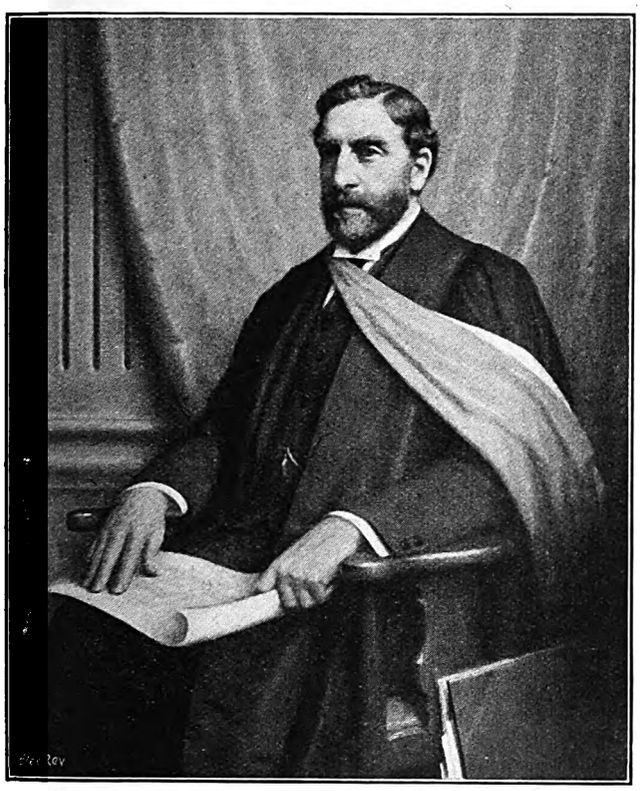

Fig. 1.—The Hopkinson Portrait.

its membership, or of outstanding scientists who contributed to the development and progress of the profession.

Three years ago, however, a start was made to remedy the deficiency, and most appropriately portraits in oil of Michael Faraday and Lord Kelvin were chosen to be the first to be hung. The latter (a reproduction of the portrait painted by Herkomer for the Institution of Civil Engineers) was provided by the I.E.E. and executed by Mr. George Harcourt, R.A. The former, by the same artist, was the gift of Mr. Sidney Everest, to whose initiative the scheme is understood to have been due.

The next pair was presented a year ago, the donors being Sir George Sutton, Bt., who gave a portrait of Chas. Wheatstone, painted by Sir William Llewellyn, K.C.V.O., R.A., and Mr. R. W. Paul, who had taken the opportunity of a visit to northern Italy to commission Signor G. Palanti, of Milan, to paint an oil portrait of Volta.

The third pair was formally accepted at last week's meeting. Both of them were painted by Mr. R. H. Campbell, and we have pleasure in reproducing them on this page. Sir T. O. Callender presented the portrait of Dr. John Hopkinson, whose widow and family gave much assistance to the artist. Mr. Ll. B. Atkinson presented the likeness of James Clerk Maxwell, in which case Sir Ambrose Fleming and Sir Arthur Schuster helped the artist with regard to colouring and to the clothing worn, as well as in selecting from scanty material the portrait which it was judged would best serve as a foundation. Under the circumstances the artist is to be congratulated, for his commission must have been quite an undertaking in view of the fact that the available material on which to base the portraits was so limited.

It may be added that the instrument to be seen on the table in the Maxwell portrait is a likeness of the original spinning-coil device, designed by Lord Kelvin, with which the British Association ohm was determined, in 1873 we believe.

The six portraits, which have been hung in the lecture theatre of the Institution, enhancing the beauty of the oak panelling, are admirable in themselves and splendid indeed in theme. What member can look upon them without a glow of pride—and a sense of gratitude to the donors?

In presenting the portrait of Dr. John Hopkinson to the Institution at the general meeting on November 7th, Sir Tom Callender said he knew Hopkinson, both privately and in business, for many years. Hopkinson was a congenial and pleasant character, and he was always open to discuss all sorts of things, particularly mountaineering. The records of the Royal Society were full of accounts of his achievements, and the compiling of a list of patents for which he had been responsible had proved too big a job. Sir Tom said that Hopkinson was an outstanding figure in the engineering world, even in his young days when he left Cambridge, and the fact that he began life as a lighthouse engineer had proved to be a happy augury. Referring to Hopkinson's 3-wire system, Sir Tom said that the man who made it possible to distribute electricity over greatly extended areas was deserving of more than honour.

Mr. W. M. Mordey, past president, who accepted the portrait on behalf of the Institution, said he knew

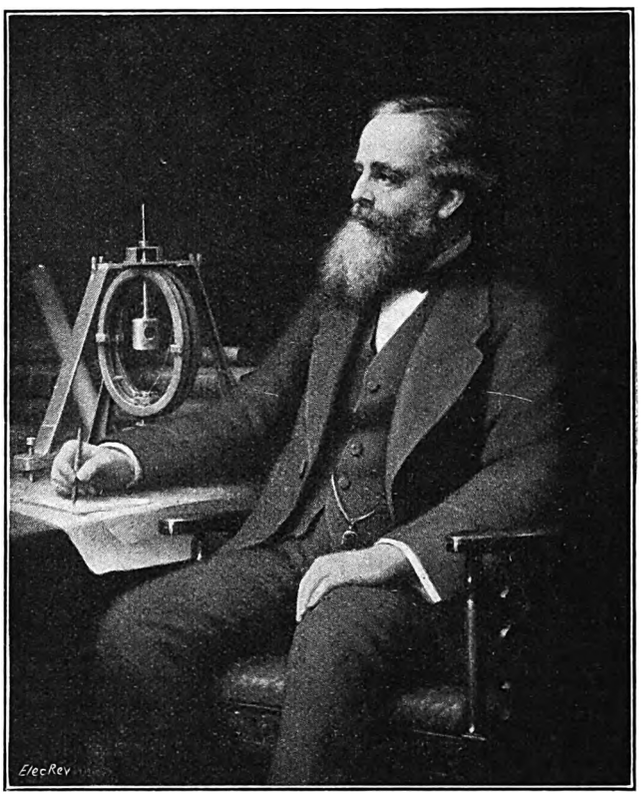

Fig. 2.—The Maxwell Portrait.

Hopkinson and could testify to the likeness being most lifelike. He referred to the occasion 20 years ago when he accepted for the Institution a bust of Hopkinson which was presented by Bertram Hopkinson on behalf of his mother. Mr. Mordey expressed his desire to draw the

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attention of the younger members of the Institution to the sketch of Hopkinson's career in Volume 44 of the *I.E.E. Journal*.

In presenting the portrait of J. Clerk Maxwell, Mr. Ll. B. Atkinson referred to the difficulties that were met with in trying to find a suitable photograph from which a painting could be produced. Finally a side-face photograph was selected and given by Sir Ambrose Fleming. Referring to Maxwell's work, Mr. Atkinson said that many of his calculations, with certain modifications, were accepted as standard to-day. Quoting from published expressions on Maxwell's character, Mr. Atkinson said that the leading feature was his grand simplicity.

Sir Ambrose Fleming accepted the portrait, which, he said, was of Maxwell at his best. He had attended Maxwell's lectures and worked under him during the last few years of Maxwell's life, and he trusted that one day it would be possible to have Maxwell lectures at the Institution. He was not only a scientist and an investigator, but he was a truly great man.

The president summed up the general appreciation of the Institution of both portraits, and offered the highest thanks of the members to the donors.

Electricity Supply at Swindon.

Descriptive details of the plant installed at the new steam-driven Moredon station, which has an initial capacity of 11,250 kW.

UNDER the provision of the Swindon New Town Electric Lighting Order, 1895, the municipal electricity supply undertaking was established in 1902, the original scheme having been designed and carried out by Messrs. Lacey, Clirehugh & Sillar.

The plant consisted of Lancashire boilers and dynamos driven by reciprocating steam engines; it was augmented in 1908, and in 1913 the first steam turbine-driven set was installed. The installed capacity was then 1,400 kW (5 sets), all d.c., 3-wire, at 440 and 220 volts.

To meet the demand for power from the Stratton munition factory, three water-tube boilers and two 3-phase 1,000-kW alternators were installed in 1918. Though the munition factory had by then been closed down, the continued increase of the load necessitated the addition of one more boiler in 1922 and one 1,000-kW d.c. generator in 1924. Thus the installed capacity reached 2,400 kW d.c. (6 sets) and 2,000 kW a.c. (2 sets).

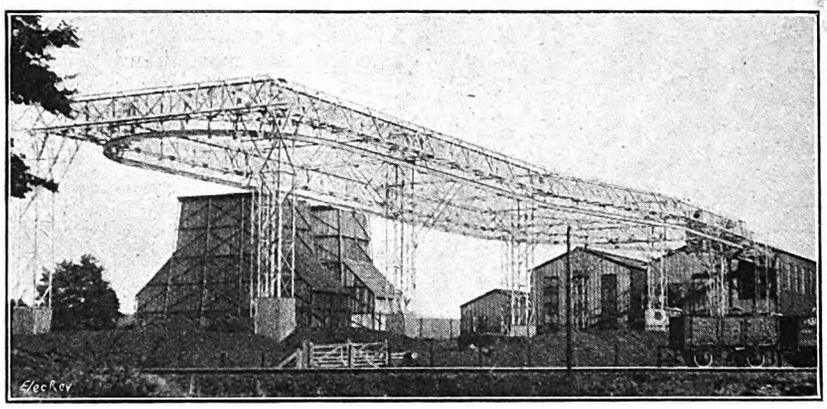

Fig. 1.—The Moredon Power Station.

In July, 1925, a temporary supply of electricity was furnished to the Swindon works of the Great Western Railway Co. and, as the site of its old power station had by then been utilised to its full capacity, the Corporation decided to build a new generating station, which was sanctioned by the Electricity Commissioners in June, 1926. In November, 1927, an agreement was concluded whereby the municipality undertook to provide the G.W.R. Co. with all the electricity it would require for a number of years, and as a result the new generating plant carried a load of 200 kW during its first year of operation; a maximum load of 4,700 kW was reached during 1928-29, with an output of about 11 million kWh, the initial installed plant capacity being 11,250 kW (four turbine-driven sets).

The Borough Electricity Committee is building up a substantial reserve fund, and its undertaking appears to be in a sound financial position; but the reorganisation scheme has cost £320,000, approximately, some £7,000 less than the estimate of the consultants, Messrs. Preece, Cardew & Rider. However, that figure represents £28.44 per kW of plant installed, and the Committee and its electrical engineer, Mr. A. Nicklin, will be well advised to emphasise the production cost rather than consider the capital cost of the whole undertaking when it becomes necessary to discuss the relation of the new station to the Central Electricity Board's "grid."

The 11-acre site of the new Moredon station (which was officially inspected by members of the Corporation and their guests on October 26th) is in the parish of Rodbourne Cheney, now within the borough boundary and about 2.25 miles from the centre of Swindon. It is adjacent to the Cheltenham branch of the G.W.R. and also to the River Ray; the supply of water available from the river is insufficient for direct condensing, but in excess of that required as make-up for the cooling towers. The site has one advantage, inasmuch as the bed of the North Wilts. Canal, now disused, runs practically in a straight line from the station to the centre of the town, providing an ideal route for the h.p. feeder cables.

Coal is discharged from wagons into a receiving hopper, whence Babcock & Wilcox telpher coal-handling plant transports it to a dump or to the boiler house bunkers. The track is at a height of 53 feet above ground level, fig. 1, which allows the two one-ton grab telphers to run over the boiler house bunkers without gradients.

Four water-tube John Thomson boilers are installed, fig. 2, each capable of evaporating 30,000 lb. per hour, equipped with Underfeed mechanical stokers. The working pressure is 275 lb. per sq. in., and the total temperature of the steam is 700 deg. F. The boilers are fitted with integral economisers and air heaters; a steel chimney is provided for each pair and four Davidson forced-draught and four induced-draught fans are accommodated on a fan platform above the boilers, each driven by an a.c. squirrel-cage motor. "Cambridge" CO_2 recorders and draught gauges are provided, and steam-jet blowers remove soot from the boiler and economiser tubes, vacuum plant being provided for the extraction of the soot and its automatic delivery to an outside container (British Vacuum Cleaner and Engineering Co., Ltd.). The ashes are delivered into a cast-iron water

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trough in the boiler house basement; the trough contains an Underfeed immersed scraper conveyor, which carries

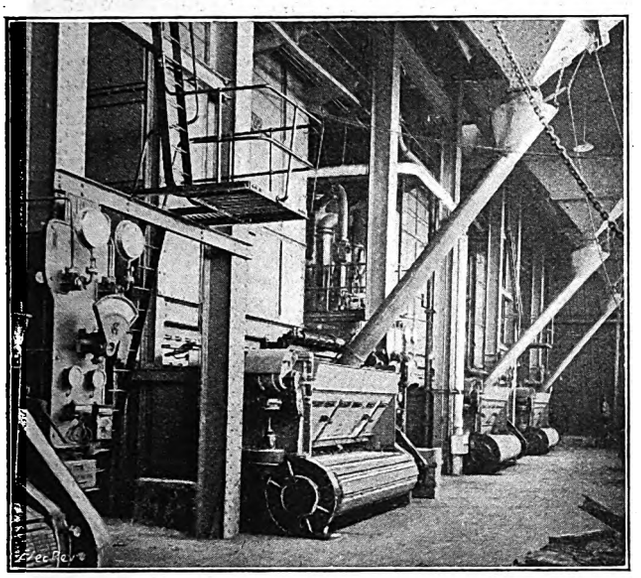

Fig. 2.—The New Boiler House.

the ashes up an inclined plane and delivers them into an outside bunker. An auxiliary Morris ash hoist has been installed.

The condensate from each turbine is passed through a boiler feed-water heater, utilising steam extracted from an intermediate stage of the turbine blading, and delivered to the closed hotwells at any temperature up to 200 deg. F. The make-up water is pumped from the River Ray to a storage tank, whence it is delivered to evaporators (P. & B., Ltd.), each of which is capable of supplying 5,000 lb. per hour of distilled water at a temperature of 212 deg. F. to two storage tanks, from which it flows by gravity through ball valves to the hotwells. The three boiler feed pumps are of the Weir steam turbine-driven centrifugal type; exhaust steam from the feed pumps is led to immersed nozzle heaters in the hotwells, in which the whole of the steam is condensed. By regulating the pass-out steam from the turbines, the water in the hotwells can be kept at a temperature just below boiling point, with the result that the quantity of dissolved oxygen in the feed water is reduced to about 0.1 cubic centimetre per litre. The distillate and hotwell tanks are entirely closed in and lagged. In order to prevent the ingress of air to the tanks, they are sealed by steam bled from the feed-pump exhaust pipes. Kent steam and water meters are used.

The first instalment of plant consists of two 3,750-kW and two 1,875-kW turbo-alternators of the Brush Ljungström type (fig. 3), 3-phase, 6,600 volts, 50 cycles. The turbine room will accommodate a fifth set, probably of 6,250 kW. Each of the condensers is provided with a two-stage air ejector and motor-driven extraction pump. Two Davenport towers have been provided, each capable of cooling 250,000 gallons of condensing water per hour. The make-up water flows from the River Ray by gravity to a pump house, which is detached from the main building and is equipped with two 4-inch vertical-shaft, motor-driven, centrifugal Worthington Simpson pumps, which deliver the water direct to the ponds of the cooling towers. Paterson chlorinating plant has been provided. The whole of the auxiliary plant is driven by alternating-current motors supplied from two auxiliary Hackbridge transformers; to provide for extensions, each is of 1,500 kVA. A Premier battery of 140 cells, having a capacity of 250 Ah at the 10-hour rate, with a charging motor-generator by E.C.C., Ltd., supplies the energy for operating the switches and, in the event of the failure of the a.c. auxiliary system, the battery will automatically take over the whole of the station lighting, which installation was carried out by Griffin, Harding and Bryant, Ltd.

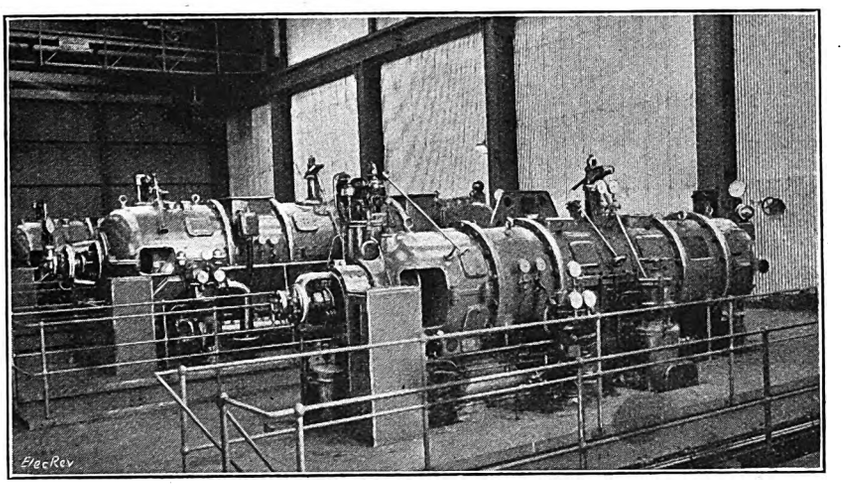

Fig. 3.—Part of the Turbine Room.

The whole of the switchgear (British Thomson-Houston Co., Ltd.), is accommodated on one floor (fig. 4). The main 6,600-V gear is contained in cubicles constructed of stoneware, with sheet steel doors back and front. All the oil switches are designed for a continuous load of 500 amperes per phase and a rupturing capacity of 250,000 kilo-volt-amperes.

Four 6,600-volt 3-core feeders of 0.2 sq. in. section transmit energy to the new main town sub-station, which has been built on the site of the old power station, and to a sub-station which has been established in the works of the Great Western Railway Co. All the cables and pilots were supplied by Standard Telephones & Cables, Ltd. Two feeders run direct to each sub-station; these are, in addition, interconnected, and telephone wires are laid with the cores of the pilot cables. The main sub-station converts the a.c. to 220- and 440-volt d.c. for general distribution. The plant consists of E.C.C. rotary convertors, three of 2,000-kW capacity each, and two of 500 kW each. The B.T.H. 6,300-volt switchgear is accommodated on the upper floor in sheet-steel cubicles, and the 440-volt direct-current switchboard is on the lower floor. A standard gauge railway is provided along the fronts of the Hackbridge transformer cubicles, which are outside. The Great Western Railway Co.'s sub-station contains 6,300-volt B.T.H. switchgear in

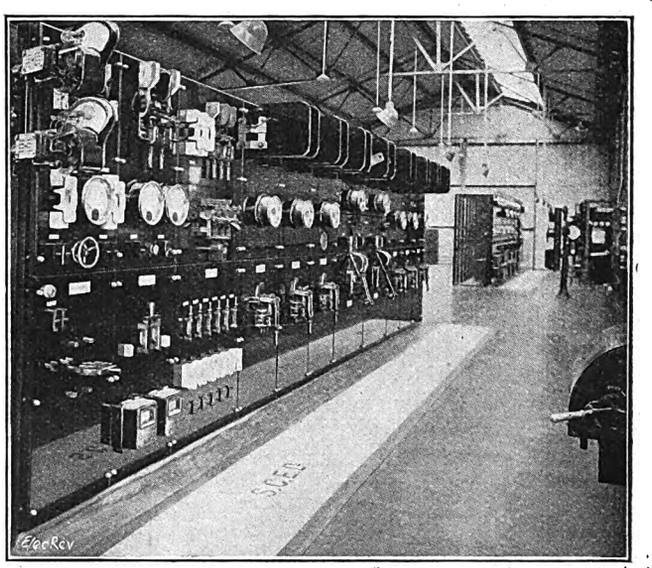

Fig. 4.—The Switchgear Bay; Auxiliary Board in Foreground.

sheet-steel cubicles and three step-down Hackbridge transformers of 2,000-kVA each.

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An Electric Heating Installation.

The electric water-heating system at the Westminster Electric Supply Corporation's Eccleston Place offices.

(COMMUNICATED.)

THE heating of the offices of the Westminster Electric Supply Corporation is now carried out electrically, the old coke-fired boilers having been replaced by an electric boiler.

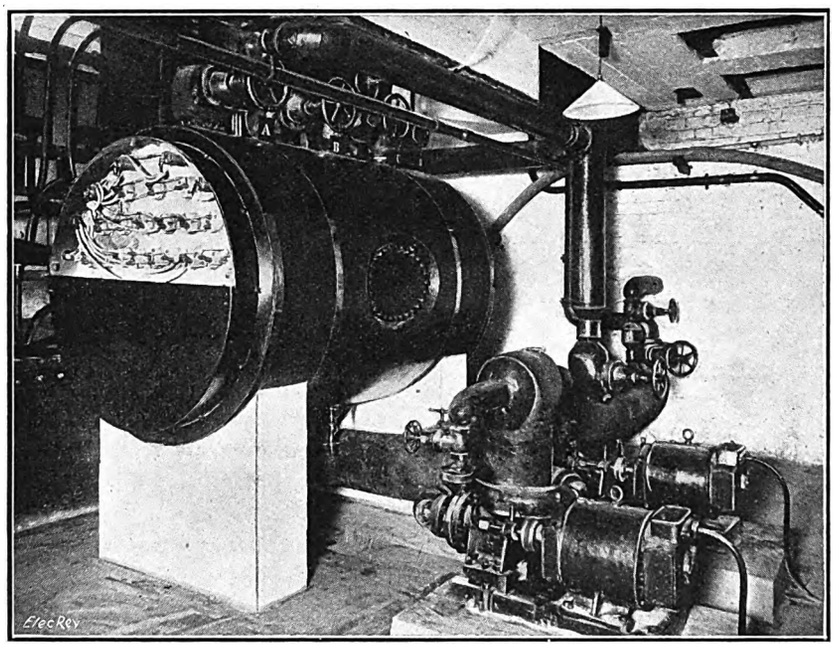

Fig. 1.—Electric Boiler, 216-kW Capacity.

The existing system of central heating by means of radiators and pipe work has been retained, as it was considered that the capital expense of installing direct electric heating in the various rooms and scrapping the radiator system would be unnecessary.

The heating required demanded an electrical loading of 180 kilowatts, and in order to allow for the most severe conditions the actual loading is 216 kilowatts. The boiler (figs. 1 and 4) consists of a cylinder of welded steel plate, 6 ft. long and 3 ft. 6 in. in diameter, lagged with 2 in. of non-conducting composition and covered with planished steel. The heating elements are inserted in the two ends, the steel sleeves that contain the elements being screwed into the ends and caulked. The elements, which can thus be withdrawn while the boiler is full of water and even partially on load, are of "Heatrae" manufacture and loaded to 3 kilowatts each; they are connected in circuits between line and neutral at 230 volts, three in a circuit, and three circuits balanced on the three phases to form one control step. The complete loading consists of eight steps of 27 kilowatts each and each control step has its own thermostat, which is inserted into the end of the boiler above the elements and actuates a solenoid contactor mounted on a control panel (figs. 2 and 3).

The panels contain a relay circuit in which a switch, pilot lamp, and the thermostat are connected, and the main three-phase circuit. When the local switch is at the "off" position that group of elements is cut out. The connections are taken back from the eight panels to a 8-way triple-pole distribution board and a 350-ampere, triple-pole, ironclad overload release circuit breaker.

Connections generally consist of 2,500-megohm Association cable in heavy gauge welded screwed tubing, the cable being asbestos covered between the panels and the boiler and the connections in the boiler being bare stranded copper covered with fish-spine insulating beads.

In order to guard against sudden loads the eight thermostats are set approximately 6 deg. apart from 185 deg. downwards. The lag on each thermostat is approximately 2 deg. to 3 deg., and in heating up from cold all the thermostats start by being "in" and are cut out one by one as the water temperature rises, until at 185 deg. all the thermostats are out. Then, as the water cools, they are cut in again one by one and an equilibrium is obtained, depending upon the external temperature, in which a number of thermostats (generally about five) perform under normal conditions a cycle of operations, taking about half an hour.

The whole boiler is switched off by the station staff for two hours from 4 o'clock, but it is found under actual working conditions that no reduction of temperature is noticeable in the offices during this period of two hours. The boiler has functioned without an involuntary stop-

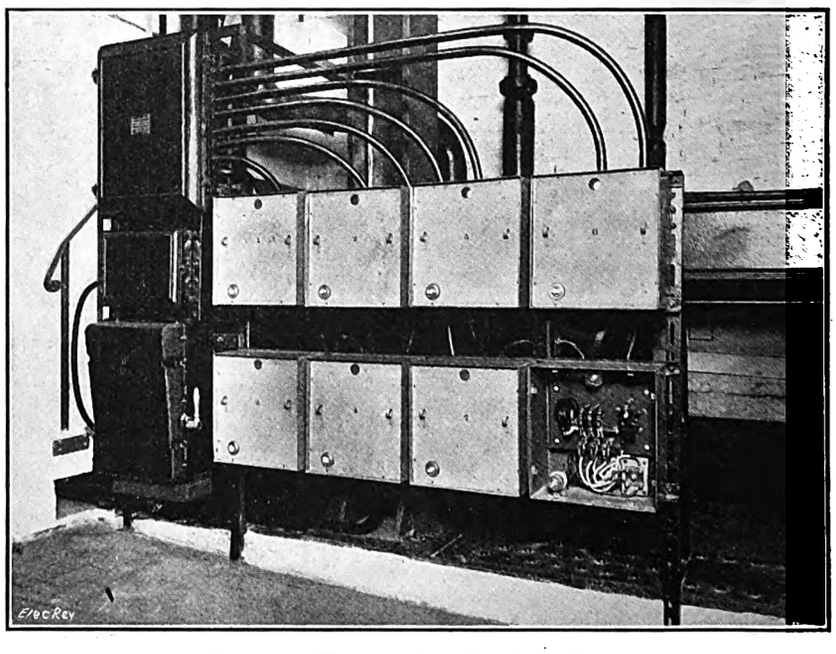

Fig. 2.—Thermostat Control Panels.

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page or breakdown during the whole period it has been in operation. Owing to the ease of use and the increased efficiency of the system, and also due to the introduction of an accelerating pump, considerably higher room temperatures are used than was the case previously when the coke-fired boilers were in operation before the modern electrical system was introduced.

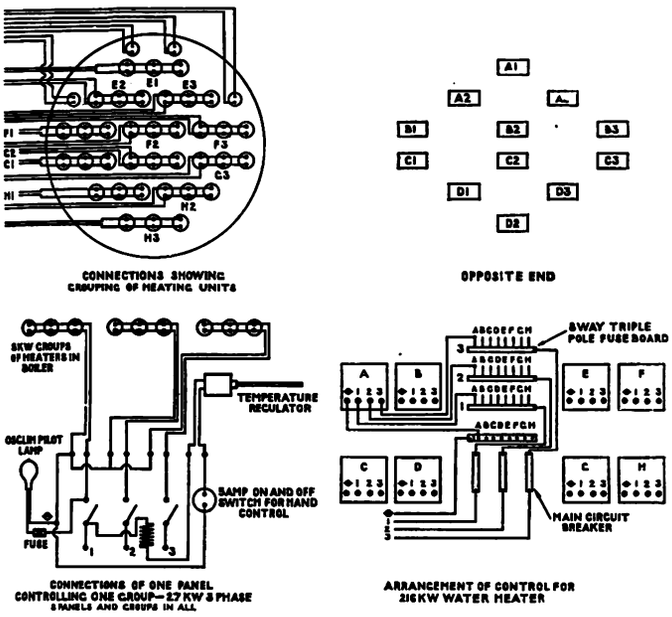

Fig. 3.—Diagram of Circuit Arrangement.

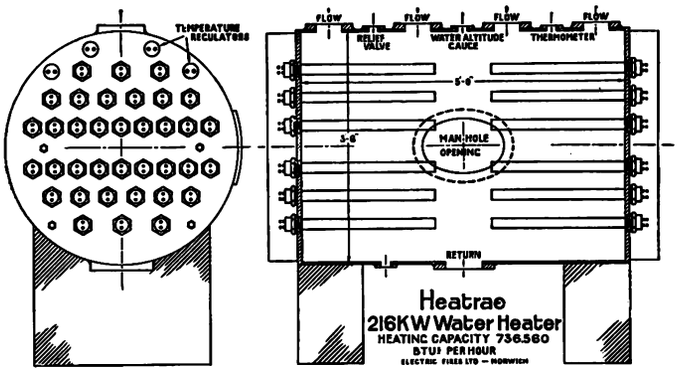

Fig. 4.—Sectional Views of Boiler.

Messrs. Troughton & Young, Ltd., carried out the installation to the specification and under the supervision of the Corporation's chief engineer, Mr. P. L. Riviere.

Electricity in Schools.

Some Views on the Advantages of Teaching the Practical Uses of Electricity to School Children

By C. H. DOBELL, A.M.I.Mech.E.

TO assist in the propaganda for extending the sale of electricity and to educate the general public in all the benefits of its numerous uses, the writer has recently advocated a cheap rate per kWh for schools, especially domestic science centres and those having evening classes, and, at the same time, that a discount should be allowed by all manufacturers on the purchase price of fittings and appliances. In that way every inducement will be given to bring up the rising generation electrically, so that in the future they will demand electricity in their own homes. The time has come when it is essential to teach electricity in the schools, not from a technical point of view, but just showing its practical services to mankind, avoiding the little knowledge that is dangerous.

The teaching of electricity in the service of man should be equally as important as the teaching of arithmetic, grammar, &c., commencing with the ordinary electric light and leading up to the vast industrial and commercial uses.

Local authorities, where they are the suppliers of electricity, are naturally the right people to undertake this education, and to introduce it into the curriculum of the elementary schools, and even in those districts where they are not the suppliers they could still do it in co-operation with the local supply company.

It is sufficient to teach the general public that, on closing certain switches, certain appliances can be brought into action, be they for lighting, cooking, refrigerating, or any other service. It is not necessary to teach them the why and the wherefore, but there are certain facts that they should know, regarding voltage, for example, lest they should think that any electrical appliance can be indiscriminately connected to any circuit. They must learn that the appliance must be made for the voltage of the system, and that the size of the leads is dependent on the amount of the current required by the particular appliance. Commencing with the simple electric lamp, the education should be carried on through house installations for lighting, heating, ventilating, cooking, &c.; how to connect up appliances, the difference between power and lighting loads, and such ordinary matters regarding electricity in every day use. With a cheap supply and with appliances at prices within reasonable bounds, demonstrations could be carried out from the most elementary stages upwards. It is not being suggested that every boy should be taught to be his own wireman, but that everybody should have a good idea of what electricity can do, should be conversant with the more common electrical terms, and should, by recognising what is meant by the wattage of lamps, &c., be able to estimate the cost of his electricity in advance, and so on.

The outcome of such electrical education would be that everyone would switch on electricity for whatsoever purpose it is needed as naturally as he takes his nourishment. The school children see the radiator switched on when the classroom is cold, the fan when it is hot, and the light when it is dark, and they see the vacuum cleaner brought into action when it is dirty; they become thoroughly conversant with electrical apparatus, which becomes part of their lives until, when they grow older, they cannot imagine homes without it. They become familiar with the telephone, they receive instruction by wireless, and altogether they learn the uses of all the appliances which go to make for domestic efficiency, cleanliness, and happiness.

Cooking by electricity is certain to be general in all the new homes, the preservation of foodstuffs in the summer by refrigerators will be adopted, if the scholars of either sex are taught the ease with which these appliances can be installed, operated, and utilised and have some knowledge of them, and can work out for themselves the prob-

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able cost per week or month as the case may be. Imagine the wonderful interest displayed in such a fascinating subject; was there ever such means of advertising a commodity as this before? Electricity with its thousands of possibilities would become the most popular subject.

The benefits of this new addition to our school curriculum would be shared by the general public, the electricity supply undertakings, the manufacturers, and the wiring contractors, and there is little doubt that it would pay them to assist by putting up the money for films of instructional value in connection with electricity supply.

[Our contributor's suggestions are worthy of consideration. We may point out, however, that special efforts were made by B.E.D.A. to secure the co-operation of the London County Council Educational Authority in the teaching of electric cooking at its numerous centres. In addition, great progress has more recently been made in educating pupils and others at Croydon, Newcastle-on-Tyne, Woolwich, Hackney, and Derby in the operation of cookers. The arrangements vary in different places; sometimes the energy is supplied free, if the centres find the cookers; sometimes girls are brought in groups of as many as thirty at a time to the electric cookery centre. But what is of even greater immediate interest is the fact that the B.E.D.A. is now engaged upon a wide-spreading scheme which will urge the desirability of all electricity suppliers concentrating upon the matter. The Women's Electrical Association is, of course, actively interested in the subject, and has used its influence effectively to the same end.—EDS. ELEC. REV.]

Electricity for the Home.

Maidstone's steady advance in the domestic field; examples of manufacturers' recently-introduced products.

MAIDSTONE, the county town of Kent, is typical of a large number of British boroughs. It is a semi-industrial district with a population of over 40,000 and a ratable value of approximately a quarter of a million sterling. The electricity supply undertaking (engineer, Mr. E. E. Hoadley) has a plant capacity of 17,400 kW, and the output is absorbed to a large extent by power requirements. There is, however, a large and rapidly growing domestic load which is being fostered by the Department's encouraging policy in facilitating installation and connection, hiring out appliances, and supplying energy at a reasonable price. This part of the undertaking's work is in charge of Mr. P. Fletcher, the consumers' engineer. The Department carries out the wiring of the houses on Council estates, but apart from this the work is done by local electrical contractors. When the Department is approached by a prospective consumer regarding an installation, he is asked for the name of the electrical contractor who persuaded him to install electricity. The work is then given to that contractor. If, however, no name is forthcoming the Department awards the contract to the next contractor on its list. A standard schedule has been adopted and a fixed price per point is paid for the work. So far as the consumer is concerned, he can either pay for the installation outright, purchase it by instalments, or merely pay a quarterly hiring charge. Payment for an installation is spread over three years and the quarterly charge ranges from 4s. 11d. for two points to 42s. 11d. for 18 points, with extra charges for two-way switching. For hired installations the charge is 1s. per quarter for each lighting point and 1s. 6d. for the first heating switch-plug point, and 1s. 3d. per additional point. The apparatus hiring scheme covers cookers (standard and small), kettles, fires, irons, automatic cisterns and wash boilers. If a consumer desires to purchase any hired appliance he is charged the list price less half the amount which he has already paid in hire charges. The larger cooker employed for the purposes of the scheme is the "Magnet" No. D.C. 5731 (General Electric Co., Ltd.), which was selected after extended tests and experiments. This cooker (fig. 1) is fitted with side or side and bottom heat and is intended for a family up to eight or nine persons. The oven in which the net cooking space is 16 in. by 16 in. and 14 in. high, has an enamelled interior rounded at all corners, entirely withdrawable for cleaning and fitted with detachable shelf runners. There are two circular totally-enclosed hot-plates 8 in. and 7 in. in diameter, which are arranged for three-heat control and are guaranteed for two years. A large hot cupboard is situated between the oven and the hob, and in it is the grilling chamber from which the enamelled pan and adjustable grid are removable when the hot cupboard is required for warming plates, &c. The total loading is 7,100 W and the net weight is 3 cwt. approximately (including the optional fittings, plate-rack and enamelled splashguard). The standard finish provides for an exterior, including facings and feet, black stoved enamel with the hob in mottled grey porcelain enamel. The door and switch

Fig. 1.—The "Magnet" No. D.C.5731 Cooker.

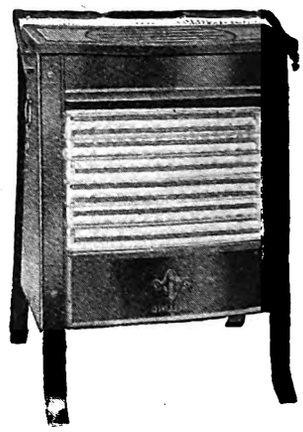

Fig. 2.—A "Belling" Fire.

panels are white enamelled. The hire charge for this cooker is 8s. per quarter.

The smaller cooker is supplied by the Hotpoint Electric Appliance Co., Ltd. It is the "Hotpoint-Falco" No. 5249 A model (fig. 3), designed to cook for a family of four. The oven is of the one-piece removable type, with an available cooking space measuring 12 in. square and 13 in. high; the loading is 1,500 W. There is a grill chamber with a 1,500-W element, and two circular boiling plates—one 8 in. in diameter (1,600 W) and the other 4½ in. (500 W). The large boiling plate, grill and oven are arranged for three-heat control. The cookers supplied to Maidstone have an all-enamelled finish. The whole of the front casting and the hob are mottled grey, and the sides and back of the oven are plain grey. The charge for the smaller cooker is 6s. per quarter. The Department considers that these cookers meet its re-

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quirements very closely. "Sadia" boiling plates are fitted, and they give very satisfactory results when suitable utensils are used. If desired, the Department provides (at a quarterly charge of 1s. 6d.) a protector-type "Premier" kettle with the cooker.

The water-heating apparatus hired out is of "Inventum" manufacture. In general, the Department supplies 1½, 4½, or 10-gallon heaters, but occasionally it deals with the 22-gal. size. The majority of these are thermostatically controlled, and the charges for them

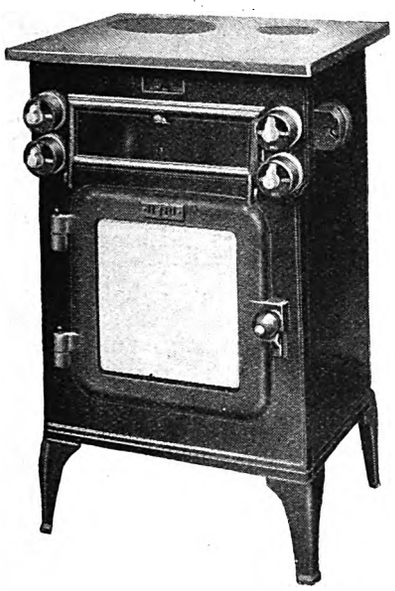

Fig. 3.—The "Hotpoint Falco" No. 5249A Model.

range from 6s. to 12s. per quarter. For 7s. 6d. a quarter a consumer can obtain a wash-boiler.

"Belling" fires are ordinarily supplied under the scheme, and three models are available, 1-kW (2s. per quarter), 2-kW (3s.), and 3-kW (4s.).

The usual practice is to hire the 2-kW bungalow model illustrated in fig. 2. This type of fire has been adopted by a large number of undertakings for similar schemes. The company attributes this to the practically negligible maintenance costs consequent upon the employment of the "Multi-parabola" fire bar and the generally sound construction of the fire. The fireclay base is made on a convex curve, and the face is split up into 75 parabolic wells. The construction of the framework is such that air is taken in from behind the bars and passes out from the top of the fire, thus adding a considerable amount of convected heat to that directly radiated by the bars.

The Department makes every effort to obtain (and retain) domestic consumers. It regularly advertises in two local newspapers and every quarter sends its consumers appropriate "literature" of manufacturers' or its own production. Recently an excellent little booklet has been prepared and circulated to 3,000 non-consumers with a special letter. This booklet contains everything that a prospective client requires to know regarding installations, apparatus, charges, &c. As a result of the Department's efforts among builders and contractors, practically every new house is electrically wired and most of them have "outlets." One builder, who is erecting 82 houses, is wiring them for lighting and putting three plug points in each, and he is strongly recommending the purchasers to adopt electric cooking. Another builder, while installing wiring for lighting, offers to install heating plugs at a very low rate. The Corporation itself has wired 1,200 houses on its estates, with eight lighting points and two "outlets" in each.

Maidstone now has a number of all-electric houses in consequence of its progressive policy, and the occupiers are well satisfied. One "all-electric" householder with an annual consumption of 13,500 kWh paid 0.7d. per kWh; another with a consumption of 10,000 kWh was charged an average of 0.76d. The cost per kWh for two smaller houses using 2,696 and 2,146 kWh, respectively, worked out at 0.812d. and 0.889d.

The domestic "all-in" tariff employs a system based on the number of lamps installed. The standing charge is 7s. per annum for each 30-W lamp or its equivalent installed (lamps used occasionally are not included). The "unit" charge is ½d. during the two summer quarters and ¾d. during the winter. A continuous supply for water heating can be obtained at ¾d. per kWh during the day and ½d. during the night hours. The flat rates are 5½d. per kWh for lighting; ¾d. and 1d. for heating and cooking in summer and winter respectively; and 2d. for power. There are also a fixed-charge system for lighting and a two-part power tariff.

The Department has also done some good work outside the domestic sphere. Examples of this are the installation of G.E.C. bakers' ovens on the hire-purchase system. One of these (of the half-sack size) is in a baker's and confectioner's premises and consumes about 10,000 kWh a year at a flat rate of ¾d. Then there are two quarter-sack ovens in the bakery of a ham and beef shop. These take about 8,000 kWh per annum.

Improved Cookers.

The "Quead" cookers of Messrs. William Geipel, Ltd., Vulcan Works, 156-170, Bermondsey Street, S.E.1, embody novel methods which create an entire revolution in modern cooking, and result in, it is claimed, a great improvement in the food (Electrical Review, August 21st, 1925, p. 319). The meat is full of gravy, the radiant heat sealing the pores and preventing egress of the juices; a considerable saving in time, trouble, and cost results, while the meat is cooked more quickly, needs less attention and requires less electricity in the process. Roasting is done entirely by radiant heat more or less on the old spit system. The joints or birds are hung on a hook, and by means of a roasting jack are kept slowly revolving between radiant red-hot elements. An automatic baster is provided, so that once the roast is started no attention is required; in fact, the door of the oven need never be opened until the roast is completed. The roasting oven is 21 in. × 16 in. × 14 in.,

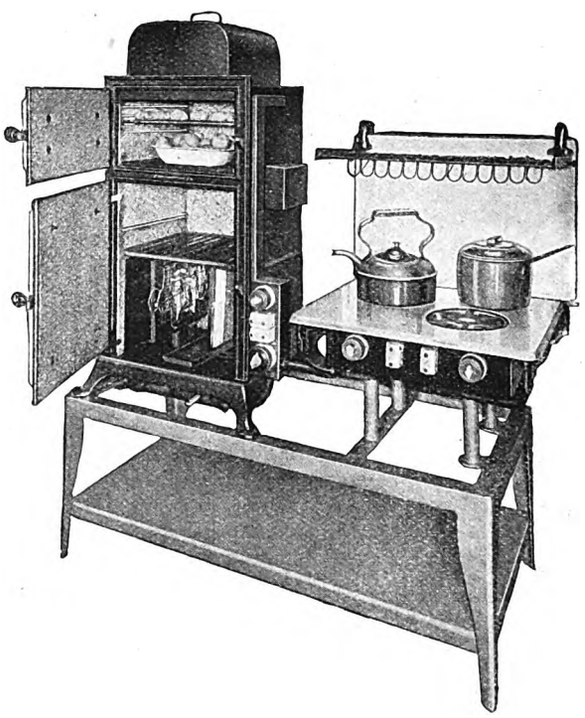

Fig. 4.—The "Empress" Cooker.

and will accommodate joints up to 20 lb., a large turkey or several fowls or ducks. Grilling and toasting are done on a new system, the food being cooked on both sides simultaneously between the radiant elements, which are adjustable to suit different conditions. Baking is done in the top oven, partly by waste heat from the roasting oven and partly by means of a top element which is specially useful for browning. The pastry, &c.,

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is claimed to be superior to that produced in an ordinary cooker. The internal dimensions are 9 in. × 16 in. × 14 in. A plate warmer of an improved type is provided in the "Empress," fig. 4, and "Duchess" models which ensures that the plates are properly heated throughout. A timing meter can be supplied which automatically warns the cook when the food is ready, thus leaving her free for other duties.

A New Fire.

The "Lilies" fire, fig. 5, is a recent introduction of Messrs. ELECTRICAL UTILITIES, LTD., Tudor Works, Park Royal, N.W.10. It uses the makers' standard

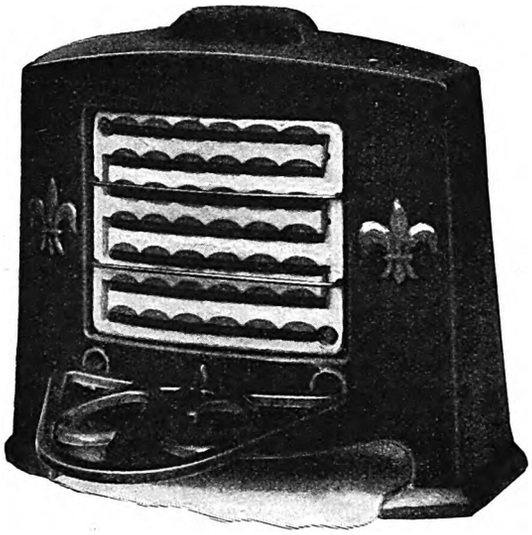

Fig. 5.—The "Lilies" Fire.

"Infra-Ray" element, but of a more ornamental design, and is fitted with a detachable trivet for carrying a small utensil or a plate of food, &c. The fire has been so designed that the casting weight counterbalances the trivet, so that it is possible to put up to 4 lb. in weight upon the trivet. The loading can be either 1 or 1½ kW. The fire can be supplied in the new fabric finishes, which are extremely attractive and are proving very popular this season. The "Lilies" fire can be supplied in grey, green, brown, and white vitreous enamels, and also in red, blue or black "fabric" finish.

Domestic Electrical Appliances in U.S.A.

The electrical appliances in each of 3,203 typical homes in the United States were listed in connection with a recently completed survey undertaken for the Society of Electrical Development. Electric irons were found in 96 per cent. of these homes; cleaners in 87 per cent.; toasters in 70 per cent.; washing machines in 46 per cent.; and percolators in 32 per cent. All these appliances were reported to be used regularly, except the percolator, which was used for a small proportion of the time only. Portable lamps, found in 98 per cent. of the homes, were reported to be the only ones of the principal health and convenience appliances in regular use. Curling irons and radiant heaters were reported in regular use in only half the homes that had them, and fans in one-third. Irons, representing 14 per per cent. of the total number of appliances in use, were reported to account for 22.5 per cent. of the energy used by the appliances, and ranges, although numbering only 1.9 per cent. of all the appliances, for 23.3 per cent.; while cleaners, numbering approximately 20 per cent., were reported to account for only 5.6 per cent. of the energy. Refrigerators, although only in 3.9 per cent. of the homes, were said to account for virtually 30 per cent. of the current used by all appliances. Of the 3,179 housewives interviewed, 46 per cent. expressed the desire to do more of their housework with electricity. Of these 1,449 women, 37 per cent. wanted refrigerators, 22 per cent. electric ranges, 20 per cent. washing machines, and 20 per cent. ironing machines. The fact that the cost of appliances and installation was beyond their means was the reason assigned for not having more appliances in 58 per cent. of the cases, while the cost of the current was the reason assigned in 16 per cent.

Improving the Load Factor.

Some Notes on, and Suggestions Regarding, the Development of the Domestic Water-heating Load

By A. W. LYNN.

MR. C. S. DAVIDSON'S attractive article on water heating* has doubtless been read by many hundreds of men and women in the electricity supply industry who are equally keen to foster the use of electricity for domestic purposes, particularly in the direction of water heating, admittedly an excellent medium for improving the load factor.

However, from information gathered from various quarters where this subject is being closely studied, there can be no possible doubt that water heating on the main storage tank system has one very distinct disadvantage, and that is the cost to the consumer. At three units a penny, a heavily loaded immersion heater, even thermostatically controlled, is not necessarily an economic proposition, having regard to the unavoidably heavy radiation losses.

Thousands of users of electricity in suburbia, many of whom are enjoying the boon of electric cookers and coppers, are most certainly not in a position to give consideration to this system of water heating, and therefore it behoves central station engineers to put before their customers something which is really cheap and efficient.

Thus, the installation of water heaters with capacities of 10, 15, or 20 gallons over sinks and baths is a proposition well worth considering, and I venture to state that these appliances, of which I have had good experience, are anything but playthings; further, the expense of installing them is more than reasonable. So far as the consumer is concerned, the cost is approximately £2 for plumbing only, as it is advisable for the supply authority to carry out the electrical part of the work free of charge.

The supply undertaking in which I am employed first hired out electric water heaters fitted with main switches at the low price of 1s. 6d. per heater per quarter, and the electricity consumed was registered by the heating and cooking meter. Next, in order to induce people to patronise water heating by electricity, my chief was responsible for persuading his Committee to reduce the price to one halfpenny per unit (separate meters being installed), on the understanding that the water heaters were in circuit continuously, day and night, and consequently all new water heaters were installed *minus* switches. The majority of people who had already installed electric water heaters "came over," but in some cases the registration of the meters revealed the fact that use was still being made of the switches which had been fixed on the old installations. In these isolated cases the consumers have been called upon to pay ordinary heating rates for energy consumed, and double the hire charge. This is apt to cause

*"Problems of the Peak," ELEC. REV., August 16th, 1929, p. 273.

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a little friction in some quarters, and that is the reason why a consumer should be called upon to sign an agreement to hire a heater for not less than two or three years at an agreed charge per quarter. It is the only way to ensure a fair return when an undertaking has arrived at a very low tariff, based on a 24-hour load; further, it gives no chance to that section of the community which quibbles at the slightest opportunity, and looks upon the cheating of a railway company or borough council as perfectly legitimate.

At this point it is as well to remark that in every business there is such a thing to contend with as "human nature," and this should not be lost sight of when considering the question of increasing output and improving load factor. Therefore, after studying the question from many angles, giving particular attention to the weird and wonderful stories of those consumers who deliberately "short circuit" the terms and conditions of supply, I am of the opinion that *one-heat* water heaters only should be supplied, *with* switches, but *without* meters, at an all-in price to include energy and hire of appliance.

I have a 10-gallon water heater installed in the bath room of my six-roomed villa, and, of all the good things with which I have supplied my wife, she declares that this is the best, and I heartily agree with her. It is fitted with two heats (150 W and 300 W), but the high heat has never been used. I must admit that in wintry weather the temperature of the water shows an appreciable drop, but we have gone a long way to overcome this slight drawback by fitting the heater with an "overcoat."

With a wattage of 150, the consumption recorded should be 1,314 units per annum, and it speaks well for the efficiency of my heater when I state that my meter registered 1,358 units during the year ending June 30th, 1929.

My suggestion is that a 10-gallon heater should be fitted with one 175-watt element, and this, I think, would give perfect satisfaction both in summer and winter.

An element rated at 265 W should be fitted to a 15-gallon heater, and so on. In connection with a 10-gallon heater, the energy recorded on a 100 per cent. efficiency basis would be 1,533 units per annum, but it would be best to take a figure of 1,600 units.

With electricity at one halfpenny per unit, the annual cost, including 6s. meter rent and 6s. hiring charge, would be £3 18s. 8d., but I think it quite safe to reduce this figure to £3 14s. Thus it would be very satisfactory from the undertaking's point of view to be able to say to a consumer—"We will supply you with a 10-gallon water heater at an inclusive rate of 18s. 6d. per quarter (or 1s. 5d. per week). No meter will be fixed, and you may switch it off when you like, or you may have it on night and day for ever." This is where one pierces the armour of "human nature." Tell a man with a meter that you *expect* him to use a thing night and day, and he will take a keen delight in saving a penny at every opportunity. However, tell him that no meter will be installed and that he *may* keep the current on night and day, or switch it off when he so desires, and he promptly has his pound of flesh! And this is exactly what the undertaking wants him to do. Of course, each station must base its charge on the coal cost, but I consider that the quarterly charge to the consumer should be in the region of £1 per quarter.

At the all-in price of 18s. 6d. per quarter, the return to the department, after allowing a fairly wide margin for loss of efficiency, is .555d. per unit. At the station at which I am employed, our coal and oil figures total .329d. per unit, which leaves a margin of .226d. per unit (or £1 10s. 1d. per heater per annum), a sum more than enough to cover repayment of capital, distribution losses, and repairs, which are practically negligible. Further, there is no meter to purchase and overhaul, a point worth seriously noting.

With a thousand heaters in circuit (and we boast that number), it will be seen that the output of a station adopting my suggestion would increase by 1,600,000 units for an additional load of not more than, say, 183 kW, figures which speak for themselves.

As the coal cost and the price per heater fall, so the charge for the heater could be lowered, and in my opinion, if the subject is properly tackled, it should be comparatively easy to persuade the majority of consumers to install one or two water heaters in their homes.

It should also be borne in mind that water drawn from this type of heater enables a consumer to reduce his cooker consumption, whether it be for electricity or gas, as water may be drawn from the heater at something approaching boiling point before a kettle or saucepan is placed on the hotplate of the cooker.

In my own case, the cooker accounts show a reduction of about 7s. 6d. per quarter during the past year. In addition I save at least 1s. per week in coal, as one day was always set apart for stoking a big kitchener in order to prepare water for several baths, &c., so that my heater is really costing me nothing extra.

In addition to storage water heaters, we have many small thermostatically controlled heaters fitted over sinks, but it would not be a difficult matter to take an exhaustive test of this type of heater in order to arrive at an all-in price to charge a consumer, and so eliminate meters altogether on the water heating circuit.

I agree with Mr. Davidson that heating water in the main storage tank is an excellent proposition from the undertaking's point of view, but the prospect of doing really big business in this direction is very remote, as only people with a fairly long purse are able to take it up. It is as well to be perfectly frank on this point. Money talks, and it has a deep voice where a man of small means is concerned! The ordinary middle class man with a moderate salary cannot possibly give the question serious consideration, owing to the cost, and after all, in a six- or eight-roomed villa, water is not in continual use. The average housewife requires a small amount of hot water upstairs for cleaning purposes, and a 10-gallon heater in the bath room will supply all her needs in this direction, in addition to which it will permit of one bath per person per day, and shaving and washing water in the morning.

A similar heater, or, alternatively, a heater controlled by a thermostat, fitted over the sink, will also be ample for the requirements downstairs.

Thus we do away with meters, expensive time switches, the wages of a mechanic, meter readings, the dictation of diplomatic letters to those consumers who are always on the look-out to evade regulations, and the ledger entry of meter rents. The only ledger entry is 18s. 6d. per 10-gallon heater, and for this amount 400 units are entered in the column headed "units at .555d."

In the case of a 15-gallon heater, the revenue would be 27s. 9d., for which 600 units would be entered, and so on.

It is my firm opinion that if station engineers experiment with "one-heat" water heaters on the all-in system, very big business will result, although, as Mr. Davidson rightly points out, due regard must be paid to the price with which supply authorities will be charged for a bulk supply.

In conclusion, assuming that a station with an output of 22,000,000 kWh. and a maximum demand of 10,000 kW instals, say, 4,000 water heaters of an average capacity of 10 gallons each, the effect on the load factor will be exceptionally good. In the case quoted above the output would increase by 6,400,000 units, but the plant at the station would be called upon to deal with an additional load of less than 750 kW, which means that the station load factor would increase from 25 per cent. to nearly 30 per cent., while the effect on the coal costs would certainly please the station superintendent or combustion engineer, to say nothing of the chief.

There is no limit to the possibilities of this class of supply, which could certainly not be connected with that bugbear of all electricity supply engineers—"Problems of the Peak"—which constitute a serious barrier to the realisation of those fond dreams we are apt to have regarding a cheap supply of electricity.

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Merchandise Marks Acts.—II.

In this, the second, article upon the subject, the author discusses various matters arising under the last (the 1926) Act.

By W. ERIC JACKSON, LL.B., Barrister-at-Law.

SECTION 1 (4) of the Merchandise Marks Act, 1926, provides an exception to the rule that imported goods which are sold under a British mark or name shall be marked with the country of origin. This exception is in regard to packing materials. The indication of origin need not be shown with the trade mark on articles used " as coverings, reels, labels, or otherwise as articles in or with which goods made in the United Kingdom are to be sold," provided that the trade mark if applied was applied with the consent of the manufacturer. This means that if the reel itself is made abroad and is marked with a trade mark, the country of origin of the reel need not be shown. Whether the same applies to all cases in which goods are sold with other goods remains to be seen. If a dealer wishes to use some patent type of carton which bears a trade mark and ordinarily comes within the Act, it is not necessary to mark the carton with the country of origin.

Now there is another class of case with which the Act deals. These are imported goods which do not bear any name or trade mark which is British, and include goods which bear a foreign name or mark, and goods which do not bear any mark at all, such as raw materials. Such goods do not have to be marked until the committee appointed under the Act decides that in the interest of British trade they should be marked. This committee consists of persons, commercial or official, appointed by the Board of Trade, and it hears, in public, evidence and the representations of persons concerned. Its reports are laid before Parliament and then an Order-in-Council is made specifying the manner in which the goods are to be marked. In special circumstances, where hardship might otherwise be caused, exemption from the Order may be given.

The indication of origin means either the word " foreign," or the word " Empire," or the name of the actual country of origin. The dealer has an option and can choose which of these forms he likes, but the wording must be conspicuous. Where there is an Order-in-Council dealing with the goods, the Order will generally say how the mark is to be displayed.

It now remains to consider what is meant by " imported goods." The Act contains some explanation, but, like most Acts of Parliament, the wording of the explanation is such that it itself needs explaining. Imported goods do not include goods which since their importation have undergone some substantial change, by some treatment or process. To put a battery into a pocket lamp will not be a change, nor perhaps to wind wire on to a coil. Merely cutting up goods or combining them will not confer exemption of this kind; but when foreign fabric is used to cover electric lamp shades it is difficult to know what the position is. The safest thing to do is to mark the finished article in such a way as to indicate that the fabric is foreign. To import foreign brass and copper and make the metal up into fittings would, of course, be such a change as to justify not marking the finished article.

Articles which have been manufactured in this country originally and are, after exportation, brought back here are not deemed to be imported, and therefore need not be marked. But the goods must not have undergone any substantial change while abroad, or they will lose this exemption.

In cases in which goods have been made in this country and sent abroad to be treated in some substantial way, the indication of origin must contain some indication of the change, either by a statement of the process undergone abroad, mentioning the country, or by an indication of the particular stage of manufacture which was undergone in this country or the Empire. Thus goods may be marked " Printed in Germany " or " Italian dried," these being indications of the process undergone abroad. The goods being otherwise made in the United Kingdom, the marking is sufficient. The other alternative marking includes such terms as " Foreign cured " or " Empire dried," these being indications of the process which was undergone after manufacture in this country.

In all other cases, such as when goods are made abroad and merely packed or assembled in this country, they will be deemed to be " imported " and must be marked as foreign. The trader in this country can, if he likes, put any other indication on the goods, such as " Assembled in England," in order to show what part of the marketing process was done here. The Act does not forbid this; it only deals with substantial changes.

The Act of course deals with cases of infringement. Any person who sells or exposes for sale any goods which are not marked when they should be, commits an offence and is liable on a first charge to a fine up to £5, and on a subsequent charge to a fine up to £20 and forfeiture of the goods. If any Order-in-Council is disobeyed, the penalties are the same.

In the case of imported goods which bear no British name or mark, and to which the Act applies only if an Order-in-Council is obtained, all advertisements must bear an indication of the origin of the goods, otherwise an offence against the Order will be committed.

Section 5 (3) of the Act provides that when goods which ought to be marked under the terms of some Order-in-Council are sold in conjunction with other goods, then the goods must be separately marked. Thus the fabric of a lamp shade, if dealt with under an Order, should be marked. The sale or distribution of samples is prohibited unless they bear an indication of the country of origin.

The dealer who finds that he has committed any of the above-mentioned offences has the following defences open to him. He must show that he took all reasonable precautions against committing an offence, that he has no reason to suppose that the goods were those to which the Act applied, and that on demand he gave all the information he could which would lead to the tracing of the real offender. In addition to this, he must show that he acted innocently. If he can do all this, he will escape the penalties of the Act. The Act further provides that the removal of any mark indicating the origin of the goods is in itself an offence, and the same applies to marks on goods imported wholesale. But the offender can defend himself by showing that the alteration or removal of the mark was not done for the purpose of concealing the origin of the goods.

Of course the dealer is himself primarily responsible for any offence committed in the course of his business, but the Act recognises that none the less an employer may have careless or foolish servants. Section 6 provides that when an employer is charged with an offence under the Act and the offence was in fact committed by a ser-

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vant, the employer can, on giving three days' notice to the prosecution, and on laying a proper formal information at the Court, be entitled to bring the real offender before the Court, and on proving that the servant acted without his knowledge or consent and that he, the employer, has used all diligence to enforce the Act, he will be acquitted and the actual offender will be punished instead.

It should be borne in mind that the Court can treat each sale of goods as a separate offence in itself, and in this way the penalties under the Act may amount to something considerable. If the sale of several articles to different customers is to be deemed several offences, each of which may incur a fine of £5, the dealer will do well to comply with the Act, and use all means in his power to avoid the commission of any offence.

Reviews.

Vibration Problems in Engineering. By S. Timoshenko. Pp. vi+351; figs. 165. London: Constable & Co., Ltd. Price 21s. net.

This book discusses fully the vibration to be expected in various bodies under various conditions, such as masses on elastic springs, Diesel engines, loaded shafts, pendulums, motor cars, beams of all sorts, square and round disks, electric locomotives, turbine blades and disks, bridges and hulls of ships. The author goes exhaustively into the mathematical theories underlying the problems, giving fairly full equations and both approximate and exact solutions; now and then some of the steps in the process are left out and it needs considerable energy to follow the line of thought. For students who are dealing with higher mathematics, and especially those who are interested in wave motion, it would be valuable to work out and follow the examples in this book; the usefulness of pure mathematics is apparent at once.

There are full references to the literature of the subject, especially German and American papers. The book has four chapters of 60, 30, 100, 120 pages dealing, respectively, with (1) harmonic vibrations of systems with one degree of freedom (2) non-harmonic vibrations of systems with one degree of freedom, (3) vibrations in systems with several degrees of freedom (4) vibrations in elastic bodies. An appendix of 20 pp. describes some instruments for showing vibrations, and is the most descriptive part of the book.

The book is delightfully clearly printed, and only two errors were noticed; the absence of what the abscissa represents in fig. 21 and of the points o c in fig. 65. If possible the same symbol should not be used for diverse quantities. The author has done this with m which represents (*i*) the frequency of a disturbing force $Q \sin m t$ on page 26; (*ii*) as the mass of a body on a wire on page 69; and (*iii*) to denote particular points on a figure as in fig. 26 and fig. 49.

An approximation on page 69 is assumed but not stated, when the elongation of a wire is put as $x^2/(2l)$; in such cases it is certainly better to say "approx," instead of merely assuming it.

Some of the very interesting matters dealt with are: page 128, vibrations in vehicles; page 168, vibrations in shafts of motor-generators; page 191, the theory of dynamic vibration absorbers. Vibrographs of the Vibration Speciality Company, of the Cambridge Instrument Company, Geiger's vibrograph and his torsiograph and strain recorders are described and illustrated.

No mention is made of vibrations in buildings due to traffic, and very little is said about how to get rid of vibrations practically, beyond making conditions such that resonance will not occur.

Problems in Electrical Engineering—With Answers. Edited by Dr. S. Parker Smith. Pp. viii+206; figs. 5. London: Constable & Co., Ltd. Price 6s. net.

This is a collection of about a thousand numerical problems concerned with electrical engineering They are grouped into 62 sections ranging from questions on units and simple circuits to fairly elaborate problems on transmission and traction. The volume is prefaced by a table of symbols and constants, and by five illustrations of magnetisation and other curves. Each question is immediately followed by its numerical answer. Many of the questions on circuits and networks are illustrated by sketches, but there the solutions themselves are not illustrated or worked out. It is stated that an attempt has been made to cover all the subjects usually included in "heavy" electrical engineering, but this has not prevented the inclusion of some useful sections on ballistic tests and illumination. In fact the claims made are too modest, and, with the notable exception of any section dealing with instrument questions, the range covers the whole of electrical engineering outside the purely communication branches.

The book is one which may be recommended almost without qualification. The questions are for the most part thoroughly practical without being hackneyed, the arrangement is excellent, and the price is an eminently reasonable one, particularly in view of the enormous amount of work which it must have involved. The author, or editor as he is modest enough to describe himself, states that the work was commenced in 1912, and we can well believe that it has taken very many years to get together so varied and useful a collection. Every teacher of electrical engineering who has questions to set (and who has not?) should immediately add it to his library.

From the point of view of the student the book suffers from two defects or limitations, one of which could easily be remedied. In the first place, the answers are given on the same page and immediately following the questions. This will save the teacher much trouble and turning of pages, but for the student it would be better, even though the answers are given him, to have them less prominently before his eyes when he is settling down to do the problem. Sometimes not merely the value but the form of the answer will give him hints that he should endeavour to arrive at himself. A compromise that may be suggested is that the answers might be given at the end of each section. The second point, and this is one that applies particularly to the student who is denied the facilities of a good tutorial class, is that space might have been found for the full working out of an occasional problem. For this purpose it would be necessary to select a few only of the more typical and fundamental ones.

Finally, reference should be made to the excellent words of advice in the preface regarding the importance of a good tutorial class and the methods to be employed therein—advice the soundness of which a number of other technical colleges are discovering or have discovered. It is being realised more and more that students learn by what they do far more than by what they are taught, and short of having the run of a large workshop plus a laboratory, one of the best and quickest ways of "doing" lies in the tutorial class.

D. J. B.

Steam Turbines. By T. M. Naylor, M.Sc., A.M.Inst.C.E., A.M.I.Mech.E. Pp. viii+207; figs. 171. London: Chapman & Hall, Ltd. Price 12s. 6d. net.

The appearance of another book on the subject of steam turbines naturally inclines one to seek for the special reasons which have prompted its publication, when so many excellent works have already appeared from the pens of specialists.

The present volume is written, as the author is careful to point out, as an attempt to meet the requirements of engineering students in their final years at universities and colleges, although it is thought that it will also be useful to young engineers engaged in the design, construction, and maintenance of turbine plant.

From a general standpoint the book will serve a useful purpose, as it should give the engineering student a good outline of the principles of steam turbine design and construction. It must be borne in mind, however, that progress in land practice is so rapid nowadays that details change in design almost from year to year, and constructional practice as depicted in text books is apt to lag behind current practice in the shops.

The volume under review unfortunately suffers to a slight extent in this respect, and some of the practice described can hardly be considered up to date in connection with the manufacture of large turbines for land installations.

A brief opening chapter deals with a comparison of turbines and reciprocating engines and the classification of turbines and is followed by chapters on impulse turbines, disk and drum turbines, orifices and nozzles, blading, efficiencies, steam consumption, and mechanical losses. The remaining six chapters are devoted to casings and rotors, reduction gears, governing of turbines, heat accumulators, condensers, and turbine design. An extremely brief appendix deals with the use of high pressure steam and includes a list of references to papers on the subject.

The author has treated the subject matter in a practical and interesting manner throughout the text, and the use of a large number of diagrams and half-tone illustrations adds to the value of the book.

It is regrettable, however, to come across occasional statements relating to practice which require considerable modification before they can be accepted by engineers with a knowledge of steam turbine work. On page 29, for example, it is stated that the flexible coupling shown on a Parsons turbine is to prevent external thrust. While this may be true to some extent, the principle use of a flexible coupling is to give flexibility between the two shafts, particularly in cases in which critical speeds are encountered.

With regard to leaving losses, the assumption is made on page 103 that the loss on a reaction machine is about 1 per cent., and that on an impulse turbine it is higher and may reach about 3 per cent. Leaving losses, however, do not depend upon the type of machine, but upon its design, and the loss on an impulse turbine may quite conceivably be lower than on a reaction machine.

Then again on page 106, in describing the construction of modern turbine casings, the author states that relief valves are fitted and are set at about 20 lb. per sq. in. above the maximum admission pressure. This statement certainly does not apply to modern turbines constructed for land purposes and is apt to confuse the student.

The author is probably much better versed in marine turbine practice than in land machines as exemplified by power

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station plant, and it is certainly becoming difficult to follow the design of the latter, owing to the rapid developments which are constantly taking place.

On the whole the general treatment of the subject is excellent, and the author has succeeded in his attempt to deal with the requirements of engineering students and young engineers without going too deeply into mathematics.

The book is well produced and should certainly prove useful to engineering students and practical engineers engaged in the construction or operation of steam turbine plant.

L. M. J.

Short Stories in Science. By J. G. Crowther. Pp. viii+213. London: George Routledge & Sons, Ltd. Price 5s. net.

This is an interesting book. It contains ten chapters, the first nine of which consist of "accounts of recent scientific discoveries, and indications of the trends of scientific research." The tenth chapter will be referred to separately later. The preface states that many of the essays in the book were first published as articles in *The Manchester Guardian;* and this implies, as is indeed the case, that the book is written on a popular level. Yet the matters it deals with are by no means all elementary, and the author, so far as the reviewer may judge, has succeeded admirably, in the main, in making them "plain upon tables, that he may run that readeth" them. In addition to the more usual physical and astronomical and cosmological subjects, the book treats of some that are quite out of the way of the ordinary reader's acquaintance, such as, under the general heading of "Refrigeration," brown heart in apples, frozen meat, and the speculation whether a single human life could cover a period of thousands or hundreds of thousands of years in snippets, if the living body were cold-stored in the intervening dormant intervals. There is a fascinating chapter on Indian scientists, of one of whom it is related that "every positive integer was one of his personal friends," and that when a visitor once mentioned the number of the taxicab he had ridden in, 1,729, as a rather dull one (7×13×19), he replied: "No; it is a very interesting number; it is the smallest number expressible as a sum of two cubes in two different ways"!

There are over two dozen subjects dealt with in the comparatively short compass of the book, mostly in groups of three or four related details under a common chapter heading; and so the reviewer, having read the book straight through, feels a little stodgy, and bulging with undigested information. If, then, his interest in it remained keen until the very end, as it did, it is likely to be even more interesting to the normal readers, who will probably absorb its contents by piecemeal, and will thus savour them more adequately. It has already been said that the book is addressed to a popular audience, and therefore those who are experts in the subjects it deals with (the general scope of which has been indicated) will not look for anything fresh from it; but it may be confidently said that its range is so wide that even the most knowing may find one or two references in it to matters not wholly within their ken. For a popular book, it appears to the reviewer to give, within the limits of a treatment so brief as to be necessarily somewhat scrappy, a surprisingly complete and coherent account of most of the points it touches on.

A book mainly popular in its appeal should, of all books, be written with the probably limited knowledge of its readers well before the author's mind; and nothing should appear in it that they would have difficulty in finding the meaning of, or that would give them a wrong impression. *Short Stories in Science* largely avoids these pitfalls, but not completely. It might be thought from a reference on page 3 that Milton held to the cosmogenic views of Ptolemy; but, from what he wrote in lines 66 to 178 of the eighth book of *Paradise Lost*, it is clear that he at least knew of the Copernican theory, and probably sympathised with it. The terms "light-years" and "quantum" are introduced without explanation, when not many words would have been required to give at least some inkling of what they connote. It can hardly be said that the use of "particulate" as an alternative to "quantum" is very elucidative. Again, to use "florescence" twice on page 117 instead of "fluorescence" is an unfortunate slip. On page 6, the author says that "uniformities in the universe . . . imply that the laws of mechanics are being obeyed everywhere." But is it correct to refer to such "laws" (which are really only human guesses, and subject to revision from time to time as knowledge increases) as though they were like the laws of a realm, made for the guidance of its subjects? If the uniformities have any connection with the laws, do they not merely confirm their correctness within the limits of the accuracy of the observations? It may tentatively be suggested that the thought on page 6 could have been better expressed by saying that the uniformities imply that the universe is a coherent and consistent whole; but this reduces the statement to something almost tautological, and the author might therefore have been led rather to emphasise the mental comfort that comes from knowing that the more we know the less does the unexpected happen.

There is an occasional crudity of expression that jars considerably in the chapters dealing with the most abstruse subjects. "All objects, from the Belt of Orion to a kipper"; "biff one of the fixed nuts"; "swipe an atom"; "a single atom . . . bashes into certain substances"; "a gentleman must wait a little before the results of his refreshment become obvious"; "it is bashed into another state"—these do not add vividness to the tale, at any rate in the reviewer's mind, and are so out of harmony with the excellent style of all the rest that one wonders why they have been introduced.

There are perhaps not more than the average of misprints in the book. The standard of to-day is not very high in this respect, and a book may be considered well printed if it has not more than one misprint in ten pages or so. "Ammonia . . . from cooking-ovens" (page 171) is misleading, when "coking-ovens" is meant; "oxgeny," on page 70, is curious; and should not "illuminating," in line 18 on page 114, be "illuminated"? These are examples of what might have been avoided, when verbal accuracy was all-important. The book is bound in cloth of a rather trying tint. Perhaps this is in accordance with modern fads or fashions; but the publishers might at least be reminded that there are other colours.

Lastly, the reviewer, having expressed his appreciation of the nine chapters that deal with scientific discoveries and research, must state his profound disagreement with at least the premises of Chapter X on "Science and Literature." "Literature," it declares, "may be defined as a written report of the contents of the imagination. A reading of the report should evoke images in the imagination of the reader similar to those the writer saw while his imaginative machinery was active. If after complete allowance for the dullness of the reader and the abstruseness of the subject-matter, a paragraph fails to inspire a clear image in the imagination of the reader, it is certain that that paragraph is not literature." There seems to be an initial contradiction here: first of all the author demands identity of images; and then he postulates that the reader's image must be a clear one. But what if the writer's image was not clear? There are writers without number who have written to express their soul's yearnings, in words that convey no clear image because there was no clear image to convey, and yet produce thoughts in the readers' minds that are identical with the thoughts the writers had. Are not such writings literature? If Mr. Crowther takes refuge behind a citation of the abstruseness of such subject-matter, he may be asked to consider another condition he casually introduces, when, on page 199, he asks whether certain words are an adequate image of a great poet's inspiration. This is a new criterion: to demand adequacy of image is going outside the definition laid down at the beginning of the chapter. If "secret lily of lovliness" (does Humbert Wolfe really spell "loveliness" like that?) conveys to the reader an image like that which Humbert Wolfe saw when he wrote the words, the expression complies with Mr. Crowther's initial requirement, and therefore, on his own showing, is certainly literature. More might be said of this, but let the reader judge for himself. It can be truly said that Mr. Crowther's philosophising tenth chapter is by no means as successful as his other nine chapters on the ascertainments of science in conveying a clear image to the reviewer's mind.

Manchester Smoke Abatement Exhibition.

As is usually the case, the smoke abatement problem develops at smoke abatement exhibitions such as that held in Manchester (which ends to-morrow) largely into a rivalry of heating methods. Electricity, however, certainly holds it own, and the largest and most attractive stand from a display viewpoint is that of the B.E.D.A., which is a composite display arranged by a number of the local electricity supply undertakings, manufacturers, and contractors, to illustrate the numerous ways in which electricity can be used to overcome the smoke nuisance. An all-electric house is included, and as an example of the industrial side of the problem an all-electric baking plant is exhibited. The bulk of the electrical stands are showing various cooking, heating, and washing apparatus; there is, however, at least one other important way in which electricity can be used to solve the smoke problem, and that is the actual collection of the dust particles by means of electricity, which method has the additional advantage of acting as a fuel economiser. The Siemens-Schuckert electric precipitators operate with direct current at about 50,000 volts. Methods of ascertaining the amount of carbon dioxide in flue gas from boilers, and thus ensuring economic combustion, are also shown on this company's stand. "W. R." Patents, Ltd., are showing several of the "Ringrose" systems for safety in mines; the latest development is a new electrical apparatus which automatically trips all the machinery as soon as there is any danger of explosion from gases. Electric miners' lamps which indicate 2½ per cent. of dangerous gases are also included. Ferranti, Ltd., are showing a type of electric fire which is built into the hearth; it has not yet been commercialised, but preliminary tests are said to give a thermal efficiency of over 90 per cent.; the ventilating system changes the air in an average size room within one hour. Edison Swan Electric Co., Ltd., has a range of electric washers, wringers, and ironers. W. E. Beardsall & Co., Ltd., are the sole distributors of "Two-Twelve" electric boilers for supplying large quantities of water at the actual boiling point, which are used for canteens, restaurants, &c. Other exhibitors include Bennis & Co., Ltd., (smokeless stokers), the Lea Recorder Co., Ltd., and Turbine Furnaces, Ltd.

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Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

Municipal Trading at Sydney.

The Sydney (N.S.W.) City Commissioners have been subjected to severe criticisms recently for permitting the continuance of the electrical trading policy of the Municipal Council. Mr. A. Waddell, president of the Electrical Employers' Association, said that although that Association had made generous offers of co-operation the Council had refused them. He maintained that the policy was injurious to electrical traders and was political in its conception. Mr. Ellis, director of the development section of the Association, alleged that the Electricity Department was prejudiced against Australian and British products; he referred especially to cookers.

Replying to these attacks, Mr. Garlick, the Chief City Commissioner, said that both critics had misrepresented the situation. The Department could only sell electricity at an economic rate if there was an intensive development. That needed continued service and the constant canvassing of consumers, neither of which the Electrical Association was willing to undertake. It was entirely unfair to say that the Commissioners were showing any prejudice in the matter of electric cookers. At present there were on view in the showroom two Australian cookers, two Canadian, one British and one American. The Newcastle City Council had a similar system to that at Sydney and harmonious relations were maintained with the electrical traders; he failed to see the reason for the hostile attitude adopted in Sydney.

Local Exhibitions.

West Hartlepool.—An electrical exhibition organised by the Corporation Electricity Department was inaugurated on November 4th. The show included sections devoted to lighting, cookers and water heating. Cooking demonstrations were given daily, and proved very popular. An interesting feature of the exhibition was a series of demonstrations of coloured lighting, which were arranged by Mr. J. H. Parker, borough electrical engineer. On November 8th a meeting, attended by approximately 260 ladies, was held, at which it was decided to form a local branch of the Electrical Association for Women, and at the conclusion many members were enrolled. The following were among the firms having display stands:—Metro-Vick Supplies, Ltd.; Messrs. Belling & Co.; Revo Electric Co., Ltd.; Credenda Conduits Co., Ltd.; Messrs. Falk, Stadelmann & Co., Ltd.; Berry's Electric, Ltd.; Messrs. Hoover, Ltd.; Messrs. Sturge & Baker, Ltd.; and Messrs. Beatty Bros., Ltd. The exhibition was to have closed on November 9th, but owing to its popularity the date of closing was extended to November 13th.

Worksop.—Under the auspices of the Worksop Corporation, and organised by the local E.D.A. Circle, an electrical exhibition was recently held at the Town Hall. A representative display of lighting fittings, cookers, fires, and other domestic appliances was to be seen, and the exhibition aroused considerable local interest. Lectures and demonstrations on electric cooking were given, and an "all-electric" café, in which visitors were able to see the food served cooked electrically, was a prominent feature. All the leading manufacturers of domestic appliances were represented, and the Derbyshire & Nottinghamshire Electric Power Co. had a stand which served as an inquiry bureau.

Peebles-Brown, Boveri Mercury-Arc Rectifiers.

Messrs. Bruce Peebles & Co., Ltd., Edinburgh, have been granted by Messrs. Brown, Boveri & Co., Baden, Switzerland, the sole licence for the manufacture and sale in Great Britain of Brown-Boveri mercury-arc rectifiers.

Canadian Electrical Imports.

The *Board of Trade Journal* shows that during the year ended June 30th, 1929, Canada imported electrical apparatus valued at $29.285,156. Of this, the United States was responsible for $26,803,601 and the United Kingdom for $2,021,441.

The E.P.E.A. and Scarborough Corporation.

A dispute has arisen between the Electrical Power Engineers' Association and the Scarborough Corporation on account of the decision of the latter to dismiss a works foreman (Mr. Appleby). The Association endeavoured to persuade the Corporation to refer the matter to the District Joint Board, but this the Corporation has refused to do so far. The Mayor (Councillor A. Moore), who is also Chairman of the Electricity Committee, maintains that the Corporation is standing by an arrangement made with representatives of the Joint Board some time ago with reference to this particular case. In the meantime the Association has enjoined its members not to apply for, or accept, any position with the Corporation.

Russian Imports from America.

According to the *British-Russian Gazette*, the total purchases of American industrial and electrical equipment for shipment to Soviet Russia during the first ten months of the current Soviet fiscal year beginning October 1st, 1928, amounted to £4,640,000, almost double the purchases during the whole of 1927-28.

Proposed German Insulated Tube Syndicate.

It is announced that success has not attended the many months of negotiations between the makers of insulated tubes in Germany, which aimed at the formation of a syndicate for this branch. The failure is said to have caused a further fall in sale prices, which now scarcely cover the costs of production.

The "Shearer" Navy Scandal.

The New York correspondent of the *Daily Telegraph* says that three American shipbuilding companies which employed Mr. William Shearer to act as "observer" at the Geneva Naval Conference in 1927 are to be deprived, it is reported from Washington, of all further warship contracts. It is understood that the Attorney-General has informed President Hoover that Mr. Shearer really tried to break up the Armament Reduction Conference, and that his employers, either knowingly or unknowingly, were guilty of attempting to interfere with Governmental policies. The three companies involved are the Bethlehem Shipbuilding Corporation, the American Brown-Boveri Electrical Corporation, which owns the New York Shipbuilding Company, and the Newport News Shipbuilding Company.

Lamp Competition in Holland.

With regard to rumours in circulation in Holland concerning an alleged amalgamation between the N.V. "Splendor" Gloeilampenfabrieken, of Nijmegen, and the Philips Company, of Eindhoven, the management of the former is reported to have stated that there is no question of a fusion of the two undertakings. At the same time the possibility exists of an alleviation of the keen competition which has hitherto existed between the two companies and an end put to the mutual disputes regarding patents.

A Polish Cable Syndicate.

As a result of protracted negotiations it is stated that a cable syndicate for cables and insulated wires is on the point of being formed in Poland. The undertakings concerned are the cable factory in Krakow, the Cable Company in Warsaw, the Poliski Kabel in Bydgoszez, the cable factory in Dziedzice, the Skoda works, and the Siemens Company. It is proposed to open a common sales office in Warsaw, and the syndicate, in the first place, intends to bring about unification in the production of underground cables and electrical conductors.

Unemployment.

There was an increase of 19,906 in the number of registered unemployed during the week ended October 28th. On that date the total was 1.234,400, as compared with 1,214,494 on October 21st, and 1,374,741 on October 29th, 1928.

Great Britain's Radio Exports.

The *Wireless & Gramophone Trader* publishes figures showing that the total value of radio apparatus exported from this country during August last was £95,483, including valves valued at £23,724. Australia was the principal market, having taken goods to the extent of £16,802 (valves £7,714). The next in order were Peru, £8,507 (valves £859) and Japan,

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£8,397 (valves £3,984). Other important customers were the Netherlands, £5,581 (valves £159); Spain, £5,037 (valves £795); and Argentina, £4,266 (valves £911).

Reconstructed Manchester Showrooms.

Messrs. Rd. Johnson, Clapham & Morris, Ltd., have recently reconstructed their showrooms in Lever Street, Manchester, an interior view of which is reproduced herewith. Here they maintain adequate stocks of electrical accessories

Reconstructed Manchester Showrooms.

of many kinds in addition to vacuum cleaners, lighting fittings, domestic heating and cooking apparatus, &c. The company has recently been appointed a wholesale distributor of E.L.M.A. lamps.

Wages in the Engineering Industry.

A conference is to take place on November 21st between representatives of the Engineering and Allied Employers' Federation and the Amalgamated Engineering Union and other trade unions having members in the engineering industry. The subject of discussion will be the claim put forward by the unions for an increase of 8s. per week in the basic wages of time workers with corresponding increases in piece-work rates.

The last conference took place in July when, at the employers' request, an adjournment was agreed to in view of the uncertain future of the industry.

Book Notices.

"B.B.C. Year Book, 1928." Pp. 58+405; illustrated. London: British Broadcasting Corporation. Price 2s. net.—This is the third year of publication of the annual review of the aims and achievements of the broadcasting service in Great Britain and Northern Ireland, with a survey of progress that has been made in the Dominions, in Europe, and the United States of America. A considerable section of the book is devoted to the technique of broadcasting, and some of the problems of reception are also explained in detail. The listener will find the sections on standard symbols, tables and formulæ, and technical terms of considerable assistance.

"Electricity and the Women of America."—The address delivered by Miss Sophia Malicki at the annual conference (1929) of the Electrical Association for Women, at Newcastle-on-Tyne. Published by the National Electric Light Association, New York.

"High Voltage Cables: Theory and Practice of their Design and Operation," by P. Dunsheath, O.B.E., M.A. Pp. xii+161; figs. 117. London: Sir Isaac Pitman & Sons, Ltd. Price 10s. 6d. net.

Welcome to our copy of the *Punch Almanack* for 1930, and congratulations to editors, artists, contributors, and publishers alike. The best for years past, in our humble opinion.

"Direct Currents," by C. E. Magnusson. Pp. xl+495; illustrated. London: McGraw-Hill Publishing Co., Ltd. Price 22s. 6d. net.

"*Journal* of the Institution of Engineers of Australia." Vol. I, No. 9. September, 1929. Sydney: The Institution. Price 7s. 6d.

United States Electrical Exports.

The official statistics of United States electrical exports during August give a total of $11,898,809, as compared with $8,722,940 in August, 1928. The following items contributed to the increase:—Radio apparatus, from $1,007,846 to $2,302,966; telephone apparatus, from $254,474 to $503,248; refrigerators (up to 1-ton capacity), from $419,160 to $1,437,304; railway signals, &c., from $53,097 to $181,910; a.c. generators (under 500 kW), from $88,455 to $144,429; power transformers (500 kVA and over), from $50,513 to $108,028; motors (¼ h.p. and under), from $167,562 to $241,430; and motors (1 to 200 h.p.), from $229,054 to $354,929. The only large decreases were the following:—Switchboard panels (not telephone), from $127,250 to $43,235; steam turbo-generator sets, from $137,261 to $59,356; and accessories and parts for motors, from $316,646 to $213,270. Canada absorbed over a third of the exports, its share being valued at $4,113,160. The United Kingdom was second with $651,170 and Mexico third with $629,810. Other important customers were Argentina ($604,392), Australia ($593,195), and Germany ($538,176). *Commerce Reports* states that the exports to Germany were $435,000 above those for the corresponding month of 1928, due entirely to increased shipments of electric refrigerators up to ½-ton capacity. The United Kingdom and Belgium also imported a greater number of electric refrigerators. Imports of electrical equipment into the United States were valued at only $229,188.

The A.E.G. in Rumania.

As a result of negotiations which have been carried on for some time past by the Elektricitäts Lieferungs Gesellschaft, of Berlin, agreements are reported to have been entered into between a syndicate under the leading of the A.E.G. and a Rumanian concern—the Compagnie Industrielle Minière du Banat—for the establishment of a central station of an initial capacity of 20,000 kW. It is proposed to form a Rumanian company for this purpose, which will include the concession already granted by the Government for the supply of the Banat and parts of Transylvania, as well as the Rusca-Montana coal mine, which will form the fuel basis of the undertaking. The capital expenditure on the works is estimated at between 20 and 25 million marks.

Irish Free State Electrical Imports.

The imports of electrical goods, excluding machinery, into the Irish Free State during September last amounted to £61,571, bringing up the total for the first nine months of the year to £448,768, as compared with £337,941 in the corresponding period of 1928.

German Foreign Electrical Trade.

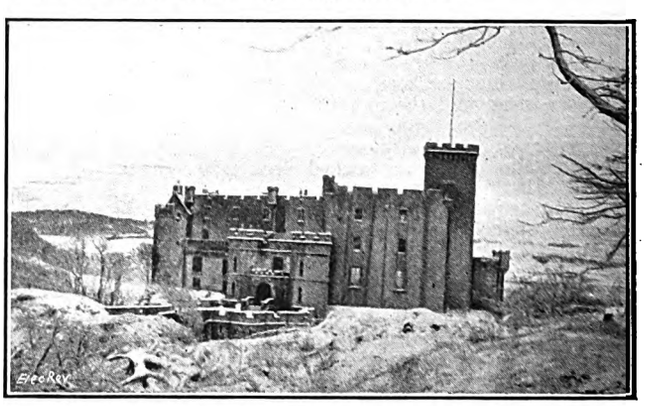
A return just issued shows that the imports of electrical machinery, cables, fittings and accessories into Germany during the eight months ended with August last attained a value of £1,750,400, as compared with £1,420,450 in the corresponding period of 1928. The exports of similar material from Germany during the same periods advanced from £15,478,650 to £18,362,050.

Electric Radiators in a Hotel.

The Hotel Metropole, one of the largest hotels in Leeds, has recently installed electric radiators in all the bedrooms. The radiators are all "Belling" 2-kW models, and are provided with slot meters. For the small sum of 6d. the occupier of a room can obtain three hours' heat. Early trial has shown that the innovation is greatly appreciated by visitors, and naturally a considerable saving of labour is effected. The energy is taken from the Leeds Corporation's supply. This hotel also uses electricity in the laundry and for toasters, grillers, &c.

Electricity after 1,000 Years.

The passing on November 6th of the Macleod of Macleod, 23rd Chief of the Clan Macleod, brings to mind the electric wiring some four years ago of the Macleod's ancestral home—Dunvegan Castle—in the rugged Isle of Skye. Dunvegan is the oldest inhabited keep in Scotland, and for 1,000 years had been lit by lamp and lanthorn, taper and torch, candle and cruisie. The walls are from 15 to 20 feet thick in places, and contractors can well imagine the difficulties which faced Messrs. Lowdon Bros., of the Temple Electric Works, Dundee, when the installation was being carried out.



Dunvegan Castle.

It is recorded that the old Cornish housekeeper, who for nearly a score of years had served faithfully in this haunted "stark strength built on one craig," received with some indifference the advent of electricity with its abundance of light. Shadows and darkness had been for long affinities of Dunvegan, and when the new lighting came she exclaimed, "It will never be quite the same." The whole installation was carried out on the "Henley" wiring system.

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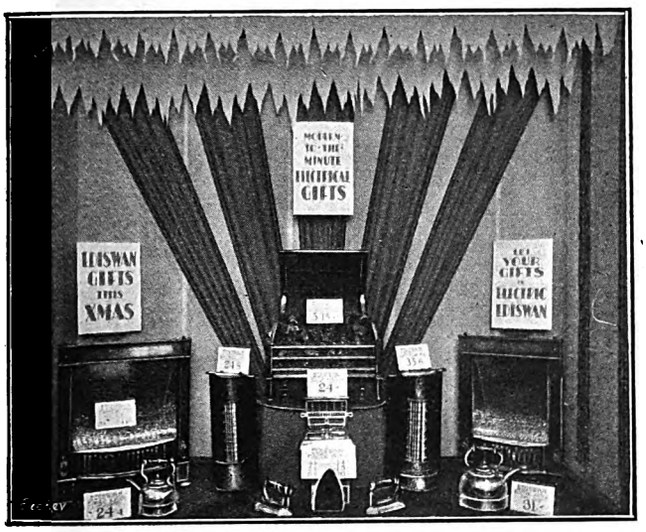
Metal Trades Benevolent Society.

The Annual Festival of the Royal Metal Trades Pension and Benevolent Society is to be held at the Hotel Victoria, Northumberland Avenue, W.C., on December 4th. The Right Hon. Neville Chamberlain, M.P., is to preside, and tickets may be obtained from him (or contributions sent) at 37, Eaton Square, S.W.1, or from the Chairman of the Board of Management, Mr. A. K. Steven, 195, Upper Thames Street, E.C.4. The prices of tickets are 15s. single and 27s. 6d. double.

A Christmas Window Display Suggestion.

An attractive window display has been constructed by the EDISON SWAN ELECTRIC CO., LTD., to illustrate what can be done in the way of Christmas displays for dealers. The background



An " Ediswan " Christmas Window Suggestion.

material used for a window 8 ft. in width consists of eight folds of white crepe paper, four folds of red, and one of green. The accompanying illustration shows the excellent result obtained.

Bankruptcy Proceedings.

E. H. NEWMAN and M. BAYNES, trading as LANGHAM RADIO, wireless manufacturers, 96, Regent Street, W.—The first meeting of creditors was held on November 6th at the London Bankruptcy Court. Mr. E. Parke, Official Receiver, reported that the debtor Baynes had stated that early in 1925 he began business as a manufacturers' agent in wireless goods in New Oxford Street, W., with a capital of £500. In 1926 he started manufacturing wireless sets, and was later joined in partnership by another person. They traded as " Langham Radio," and the partner retired in February, 1927. In January, 1927, he engaged the debtor Newman as a salesman on commission. In the following April, owing to ill-health, he offered to sell Newman the business as a going concern for £2,000. It was also agreed that Newman should manage the business in his absence and should be entitled to 50 per cent. of the profits. In 1928 he (debtor) went abroad on business and during his absence arrangements were made for the flotation of a company to take over the business. In the following September he and Newman executed a deed of inspectorship in favour of Mr. W. H. Cook, and since then he (debtor) had taken no part in the business. The liabilities, established at £11,000, included claims in respect of Marconi royalties. The only assets disclosed were a gold watch and chain. The debtor attributed the failure to liability under a judgment obtained by petitioning creditors and to the fact that the whole of the assets were included in the deed of inspectorship. The chairman said that the debtor Newman entirely disputed the petitioning creditors' claim. The meeting was adjourned for a week with a view to the appointment of a trustee.

M. KELLY, 12, Jackson's Row, Manchester, radio apparatus dealer.—The application for discharge herein was heard on November 4th, at the Court House, Manchester. The receiving order was made in 1926 on a creditor's petition, and dividends amounting to 2s. 2½d. in the £ had been paid on proofs for £1,446. The debtor came from Russia in 1895, and had traded in various commodities. He commenced the radio apparatus business in 1924 with £250 borrowed from his son. It was profitable until 1925, where there was a slump in the wireless trade. The debtor executed a deed of assignment in December, 1925, that being the act of bankruptcy upon which the present proceedings were instituted. The debtor admitted that he first became aware of his position in July, 1925, and that he had contracted debts since then amounting to at least £600. It was reported that the creditors altogether had lost between £5,000 and £6,000. His Honour refused the application, but gave leave for a further application to be made after two years.

F. W. SMITH, electrical engineer, 45, Browning Street, Leicester.—Trustee, Mr. E. Barlow, Official Receiver, 1, Berridge Street, Leicester. Released October 25th.

J. P. JAMES, 39, Edward Street, Milford Haven, Pembroke, late of Hafod, Swansea, wireless engineer.—The first meeting of creditors was held on November 5th at the Official Receiver's offices, Swansea, when the debtor ascribed his position to lack of capital, depression in trade, and unsuitable location of shop for business purposes. He submitted a statement of affairs, showing a deficiency of £106. The matter remained in the hands of the Official Receiver as trustee.

S. B. WATSON, trading as S. B. Watson & Co., 73, Crouch Street, Colchester, electrical engineer and contractor.—The following are creditors :—

	£		£
Falk, Stadelmann & Co., Ltd.	13	General Electric Co., Ltd.	37
Macintosh Cable Co., Ltd.	90	Watson, W. T.	75
		Watson, T. ...	1,600
		Watson, Mrs. D. C. ...	800

H. F. LAWRENCE, electrical engineer, 43, Canterbury Road, Margate. First and final dividend of 2½d. in the £ payable November 22nd at 5, Cecil Square, Margate.

L. W. WESTBURY (L. W. Westbury & Co. and Walsall Radio Co.), wireless goods dealer, 146, Lichfield Street, Walsall.—Receiving order made November 1st on debtor's own petition.

E. J. G. HURLES, wireless dealer, 8, Blackfriars Road, S.E.—Application for discharge to be heard November 29th, at Carey Street, W.C.

S. H. SKIPPER (S. H. Skipper & Co.), electrical engineer, 35, Broad Bridge Street, Peterborough.—Last day for proofs for dividend November 21st. Mr. F. H. Langmaid, Official Receiver, 41, Sidney Street, Cambridge.

Company Liquidations.

BAILEY & INCLEDON, LTD., electrical engineers, 34, Duke Streeet, S.W.1.—A meeting of creditors was held on November 4th, at Anderton's Hotel, E.C., when a statement of affairs was submitted which showed liabilities of £4,179, and net assets of £1,109. It was reported that late in 1928, one of the directors sued the company in respect of arrears of directors' fees, and recovered some £200. At a later date a further action was commenced, and subsequently the company passed resolutions for voluntary liquidation. The summarised trading profit and loss account for the period from August 19th, 1926, to October 18th, 1929, showed that the company's expenses were £4,008, whilst the directors' remuneration had been £2,966. The gross profit was £2,350, on a turnover of £27,683. There was a net loss of £4,623. The deficiency account at October 18th, 1929, showed that the issued capital of the company was £3,000, whilst the amount written off, the book debts, stock, work in progress, goodwill, &c., was £1,446. There was a deficiency as regarded contributories of £6,069. The company was formed in 1926 to take over a business previously carried on by Messrs. Bailey & Incledon. Some partly-completed contracts were taken over, and resulted in heavy losses. It was decided that Mr. E. H. Hawkins, of Messrs. Poppleton, Appleby & Hawkins, should be appointed joint liquidator with Mr. Weller, the liquidator appointed by the company. The following are creditors :—

	£		£
Arthurs, Ltd.	33	International Lamps ...	42
Baxter, E. J.	1,568	Keith (James) & Blackman, Ltd.	37
B. D. & Co.	110	Seeman, Arnold, & Co.	43
Bergmann Electric Wire Co., Ltd.	65	Shaw, John, & Sons, Ltd.	58
Brindley, F. & B. ...	76	Turner & Evans ...	25
Coquantin, M., & Co.	38	Wholesale Electric Lamp Co., Ltd. ...	46
Courtin & Walsh, Ltd.	53		
Falk, Stadelmann and Co., Ltd.	72		

BRITISH SOUSEDIK ELECTRIC MOTORS, LTD.—Meeting of creditors, November 18th, at the offices of Messrs. Clark and Cameron, 135, Buchanan Street, Glasgow. Liquidator, Mr. T. G. Menzies. (This notice is purely formal; the liquidation is for reorganisation purposes.)

WIRELESS LIGHTS, LTD.—Winding up voluntarily. Liquidator, Mr. G. Hay, of Messrs. Spain, Bros. & Co., 45, London Wall, E.C. Meeting of creditors November 15th, at 40, Hatton Garden, E.C.

CLAYTON WAGONS, LTD.—Winding up voluntarily. Liquidator, Sir W. McLintock, 71, Queen Street, E.C.4. Meeting of creditors November 15th, at Cannon Street Hotel, Cannon Street, E.C.4.

FULLER'S UNITED ELECTRIC WORKS, LTD.—Liquidator, Mr. G. D. Pepys, Senior Official Receiver and Liquidator, Carey Street, released November 1st.

ARTANDIA, LTD.—A petition for the winding up of this company has been presented to the High Court by Messrs. Thos. Goode & Co. (London), Ltd., 19, South Audley Street, W.1, creditors, and will be heard in London on November 18th.

BRITISH BROADCASTING CO., LTD.—A meeting of members is called December 12th at the Hotel Cecil, Strand, W.C., to hear an account of the winding up from the liquidator, Sir J. C. W. Reith.

Deed of Assignment.

C. L. F. JONES, electrical and wireless engineer, Colwyn Avenue, Rhos-on-Sea, Colwyn Bay.—Particulars of claims by November 22nd to the trustee, Mr. J. Sandford, Rhos Road, Rhos-on-Sea, Colwyn Bay.

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Dissolution of Partnership.

H. Holden & Co., motor cycle dealers and electrical engineers, 1, Union Street, Pendleton, Salford and 270a, City Road, Manchester.—Mr. H. Holden and Mr. J. Cavanagh have dissolved partnership. Mr. J. Cavanagh, of 1, Union Street, Pendleton, will attend to debts.

New Catalogues and Lists.

Straight-Lite Reflectors, Ltd., Oxford House, 9/15, Oxford Street, W.1.—A catalogue of the company's reflectors for showcase, shop window, picture, and cornice lighting. Illustrated and priced.

Messrs. Baxter & Caunter, Ltd., 219, Tottenham Court Road, W.1.—An illustrated and priced list of electrical accessories.

Messrs. George Green & Co., Chapel Road, West Norwood, S.E.27.—A catalogue containing particulars and prices of "Gee-Gee" electric water heating appliances.

Messrs. Greenwood & Batley, Ltd., Albion Works, Leeds.—List No. 2, describing the construction and operation of the Hele-Shaw rotary oil pump.

British Insulated Cables, Ltd., Prescot, Lancs.—Publications Nos. P.F. 60, 61 and 62, dealing, respectively, with Prescot single-phase meters, Helsby ebonite sheathed cables, and Prescot mistake-proof switch cut-out.

Saxonia Electrical Wire Co., Ltd., Roan Works, Greenwich, S.E.10.—List No. 11,029 giving illustrations of mercury switch tubes for a.c. and d.c.

London Electrical Co., 1, Sherborne Lane, King William Street, E.C.4.—A number of publications containing illustrated particulars and prices of electrical accessories.

Redfern's Rubber Works, Ltd., Hyde, nr. Manchester.—A well-produced brochure, with an attractive cover in gold and claret, giving an account of the growth of the company from 1900 to the present time.

Messrs. Falk Stadelmann & Co., Ltd., Veritas House, Farringdon Road, E.C.—Catalogue No. 625, illustrating "Radiolectric" and "Efescoal" fires, with dimensions and prices.

Hart Accumulator Co., Ltd., Stratford, E.—Two showcards, one advertising the company's batteries for all wireless circuits, and the other entitled "Road Sense," drawing attention to "Hart" batteries for motor starting and lighting.

Victoria Electric Plant Co., Ltd., 8-10, Spenser Street, Victoria Street, S.W.—A number of pamphlets dealing with metal lighting fittings and "Lucettes"; conical fittings for direct and semi-indirect lighting.

Mr. Alan Wright, 117, Victoria Street, S.W.1.—A list containing illustrated particulars of "Inventum" non-glowing heaters for ships, works, hospitals, garages, &c.

Drayton Regulator and Instrument Co., Ltd., West Drayton, Middlesex.—A descriptive leaflet dealing with the company's "Dial-set" temperature regulator.

Trelleborg's Ebonite Works, Ltd., 4, Union Place, Wells Street, W.1.—Three cards drawing attention to reduced prices for ebonite panels.

Messrs. Blackstone & Co., Ltd., Stamford.—A descriptive leaflet of the Blackstone unchokeable pump.

Messrs. Walker Bros. (Electrical Engineers), Ltd., Quality House, Temple Row, Birmingham.—The first number of *Electrical News* contains a number of interesting articles on electrical matters concerning the home and the business, and includes some useful notes on fuses, modern electrical fittings, irons (old and new), &c.

Messrs. Bernard Holland & Co., 17, Victoria Street, S.W.1.—Sheet No. 136, drawing attention to Diesel-driven portable rotary compressors.

Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, E.C.4.—A well-produced catalogue dealing with "Monogram" and other cast-iron fans. The publication is fully illustrated and shows a number of actual installations.

Igranic Electric Co., Ltd., 149, Queen Victoria Street, E.C.4.—Two leaflets advertising "Igranic" dual-wave coils and "Megostat" variable high resistances.

Trade Announcements.

As from November 1st, the sole selling agency for "Sterling" telephone supplies, hitherto held by the Marconiphone Co., Ltd., reverted to the Sterling Telephone & Electric Co., Ltd. All correspondence relating thereto, also any apparatus for repairs, &c., should in future be addressed to the Sterling Co., at 15, Alfred Place, Tottenham Court Road, W.1, while remittances and correspondence relating to accounts should be addressed to the company's Accounts Department, Marconi House, Strand, W.C.2.

Messrs. E. R. Morton, Ltd., 22, Bartlett's Buildings, Holborn Circus, E.C.4, inform us that they are London agents for the "Gee-Gee" electric water-heating apparatus made by Messrs. George Green & Co.

The Carrington Manufacturing Co., Ltd., South Croydon, is opening showrooms and a sales department at 24, Hatton Garden, E.C.1. (Telephone: Holborn 8202) on November 18th.

Walsall Conduits, Ltd. (incorporating the Walsall Hardware Mfg. Co., Ltd.), has removed to larger premises at Excelsior Works, West Bromwich. (Telephone: 1171 West Bromwich; telegrams: "Durability, Phone.")

The telephone number of the Ipswich branch of the General Electric Co., Ltd., has been changed from Ipswich 2379 to Ipswich 3771.

Messrs. S. Wolf & Co., Ltd., have appointed Messrs. Dempster, Moore & Co., Ltd., St. Andrew's Works, Pollokshaws Road, Glasgow, as agents for Scotland for "Wolf" electric tools.

As from November 18th, the address of Messrs. Mortimer and Gall, electrical contractors, will be 26, Cheapside, E.C.2.

For Sale.

Kingston-upon-Thames Corporation has for disposal two 1,450-h.p. motor-generator sets, one 340-b.h.p. starting motor, and one 2,200-V switchboard. Salford Corporation Electricity Department has for sale one electric travelling and slewing jib crane. Mr. G. R. Lightfoot will sell by auction, at 13, High Holborn, on November 20th and 21st, a quantity of wireless and other electrical material. Dumfries Electricity Department invite offers for the purchase and removal of certain surplus plant from its Leafield Road power station. Messrs. Newton & Co. will sell by auction at Honeypot Lane, near Alperton station, Middlesex, plant, machinery and stock in trade of Pantone Processes, Ltd. (See our advertisement pages to-day.)

Prices of Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.	Price Nov. 12th.	Fortnight's inc. or dec.
a	Acid, Oxalic ... ... per lb.	5¾d.	...
a	Ammoniac, Sal ... ... per ton	£60	...
a	Ammonia, Muriate (large crystal) ,,	£52	...
a	Bisulphide of Carbon ... ... ,,	...	...
a	Borax ... ... ,,	£25	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... ... per lb.	3½d. to 4d.	...
a	,, Perchlorate ... ... ,,	5½d.	...
a	Shellac ... ... per cwt.	£13 10s.	...
a	Sulphur, Commercial ... ... ,,	£11	...
a	,, Roll ... ... ,,	£11	...
a	Soda, Chlorate ... ... per lb.	3d.	...
a	,, Crystals ... ... per ton	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	3⅝d.	...
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton	£95 to £100	...
b	,, Wire ... ... per lb.	1/1 to 1/9	...
b	,, Sheet ... ... ,,	1/1 to 2/9	...
p	Babbitts Metal and Anti-friction Metals—		
	Grade I ... ... per ton net	£164	£6 dec.
	Grade II... ... ... ,, ,,	£116	£5 dec.
	Grade III ... ... ,, ,,	£65	£3 dec.
c	Brass (rolled metal 2" to 12" basis) per lb.	10⅝d.	¼d. dec.
c	,, Tubes (solid drawn) ... ,,	1/0¾ to 1/1	...
c	,, Wire, basis ... ... ,,	10⅝d.	¼d. dec.
c	Copper Tubes (solid drawn) ... ,,	1/3	...
g	,, Bars (best selected) ... per ton	£110	...
g	,, Sheet ... ... ,,	£110	...
g	,, Rod ... ... ,,	£110	...
d	,, (Electrolytic) Bars ... ,,	£83 10s.	20/- dec.
d	,, ,, Sheets ... ,,	£143 10s.	...
d	,, ,, Wire Rods ... ,,	£89 10s.	£4 10s. dec.
d	,, ,, H.C. Wire per lb.	11$\frac{29}{32}$d.	$\frac{1}{32}$d. dec.
f	Ebonite Rod... ... ... ,,	2/3 to 2/6	...
f	,, Sheet ... ... ,,	2/3 to 2/6	...
n	German Silver Wire ... ... ,,	2/2	...
h	Gutta-percha, fine ... ... ,,	nom.	...
h	India-rubber, Para fine ... ... ,,	9d.	½d. dec.
i	Iron, Pig (Cleveland No. 3.) ... per ton	72/6	13/6 dec.
l	,, Wire, galv. No. 8. P.O. qual. ,,	£20	...
g	Lead, English pig ... ... ,,	£23	35/6 dec.
g	Mercury ... ... per bot.	£22 15s. to £23	5/- dec.
e	Mica (in original cases) small ... per lb.	3d. to 3/-	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,,	10/- to 20/- & up	...
p	Phosphor Bronze, plane castings ,,	1/3½	...
p	,, ,, drawn bars & rods ,,	1/5	...
p	,, ,, rolled strip & sheet ,,	1/3½	¼d. dec.
p	,, ,, wire... ... ... ,,	1/6	¼d. dec.
o	Platinum ... ... per oz.	£13 10s.	...
d	Silicium Bronze Wire ... ... per lb.	1/2	...
r	Steel, Magnet, in bars ... ... ,,	7½d.	...
g	Tin, Block (English) ... ... per ton	£175 15s. to £176 15s.	£8 5s. to £8 15s. dec.
n	,, Wire, Nos. 1 to 16 ... ... per lb.	3/6	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Messrs. James Forster & Co., reporting on November 9th, said that in sympathy with the weakness in other metals, the falling price of lead in the United States, and the continued slump on Wall Street, the lead market opened on Monday last week with an easier tone, and fell away until on Thursday forward lead at one time touched £21 2s. 6d., closing at £21 5s. On November 8th there was a recovery of 7s. 6d. per ton. Prompt supplies continue to be scarce, but, as there is a prospect of ample arrivals during the second half of this month and the first half of next, there should be more than sufficient lead to meet all requirements. Consumers' demand, both here and on the Continent, remains quiet, but some buying has been done for shipment to Russia.

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Lighting and Power Notes.

Australia.—MELBOURNE.—According to the *Melbourne Argus*, the State Electricity Commission has made extensive surveys of the course of the Snowy River within the boundaries of Victoria, and is considering the possibilities of developing power from this source. At present the feasibility of developing power commercially depends on storage facilities, which the investigation so far has shown to be deficient on the Victorian section of the river.

Batley.—LOANS.—The Town Council has applied for sanction to loans of £2,800 for e.h.p. mains extensions, and £5,000 for mains and services.

Bedford.—ELECTRICITY SUPPLY.—The supply of electricity given by the Corporation to the village of Ridgmont was switched on recently. Under the Ridgmont Estate Scheme cottagers of the village are to have electricity installed at an extra cost of 2d. a week, inclusive of wiring, lamps, and shades.

Canada.—HYDRO-ELECTRIC DEVELOPMENTS.—The Gatineau Power Company, controlled by the International Hydro-Electric System, has commenced delivery of an additional 20,000 h.p. of electrical energy to the Hydro-Electric Power Commission of Ontario. This quantity of power, originally scheduled for delivery on October 1st next, increases to 182,000 h.p. the total now being delivered by Gatineau Power Company to the Commission. Of this, 150,000 h.p. is being sent over a 220,000-V transmission line 230 miles long, and is being distributed by the Commission in the Toronto area to supplement the power from Niagara Falls.

The first unit of the Calgary Power Co.'s hydro-electric development at the junction of the Bow and Ghost Rivers has been put into operation. The first stage of this development involves the installation of two units with a combined capacity of 36,000 h.p., the second of which is expected to be ready in a few weeks. The ultimate capacity at this and the neighbouring power sites will be 64,000 h.p. The development of the Calgary Power Co.'s business within the past three years has been remarkable. It now comprises a complete system extending from 50 miles north of Edmonton to the southern boundary of Alberta, a distance of 450 miles.

The Montreal Island Power Company will bring into operation this month the first two units of its development, with a total capacity of 24,000 h.p., which will be transferred to the distributing system of the Montreal Light, Heat & Power Co. The entire Montreal Island Power development will cost $9,000,000, and will eventually consist of ten units of 12,000 h.p. each, with a maximum capacity of 90,000 h.p. under normal conditions. At the present time only six of these ten units are under construction, but the whole ten are expected to be ready for service by the end of the year.

ELECTRICITY SUPPLY.—The Hydro-Electric Power Commission of Ontario, in its latest report, shows that it is supplying electric lighting and power to 268 municipalities in Ontario. As regards its domestic service, the Commission has now 408,071 consumers. The average monthly consumption amounts to 115 kWh *per capita*, and the average monthly bill is 8s.

Continental.—AUSTRIA.—A return issued recently shows that at the end of 1928 the hydro-electric stations in operation in Austria had an installed capacity of 707,492 h.p. Constructional work is at present in hand in the country on additional hydro-electric plants of a total capacity of 484,010 h.p.

ANDORRA.—The co-prince of Andorra has recently approved a decree granting a concession to utilise the water power resources of the country for electric power generating purposes to a Franco-Spanish company.

GREECE.—Negotiations are in hand between the Société Hellénique d'Électricité and an Italian syndicate regarding a scheme for developing the water power of the Lake of Stymphalia in the Peloponnesus.

SWEDEN.—According to statistics prepared by Svenska Vattenkraftfoereningen (Swedish Water-Power Association), the existing modern hydro-electric power stations in Sweden have a total capacity of about 1,544,000 installed turbine h.p. In 1927 the construction of plant for about 32,000 h.p. was commenced; in 1928 enlargements to existing plants and the construction of several private stations were started to provide an additional 52,000 h.p. The largest of these works is the Sydsvenska Kraftaktiebolaget's plant on thte Karseforsen rapids totalling 44,000 h.p. At the end of 1928 the constructions in progress were about 113,000 h.p.; in 1928 plant for 70,000 h.p. had been completed, including the big power stations at Kraangforsen, Hammarforsen and Forshuvudforsen. Among the constructions for Government-owned power stations is that of a seventh turbine at Porjus adding 18,000 h.p. and the exchange of two turbines at the Aelvkarleby station. Preparatory work has been started for the erection of a new power station at Sillre to supplement the power obtained from the Norrforsen plants.—*Reuter's Trade Service* (Stockholm).

Daresbury.—OVERHEAD LINES.—The Mersey Power Co., Ltd., is to erect overhead transmission lines to the parishes of Daresbury and Kekewich.

Eastbourne.—AREA OF SUPPLY.—At a meeting of the Corporation Electricity Committee held recently a letter was read from the promoters of the Ringmer & District Special Order intimating that, if the Corporation wished to include the whole of the rural district of Eastbourne in its supply area, they proposed to withdraw this area from the Special Order, and were prepared to negotiate with the Corporation on the matter. The town clerk reported that the promoters' consulting engineers were going to Eastbourne to discuss the Corporation's objections to the Order.

COOKER INSTALLATION.—The Committee has decided that the free wiring of cooker installations shall be extended from 30 ft. to 40 ft.

ELECTRICITY CHARGES.—The borough electrical engineer has recommended that as the 7½ per cent. on houses of small ratable value will not cover the standing charge, the minimum fixed charge on any house be £2 per annum. The matter has been referred to the Standing Sub-Committee for report.

STREET LIGHTING.—The Committee has authorised street lighting extensions and improvements at a cost of £8,000.

Felpham.—INAUGURATION OF SUPPLY.—The supply of electricity to the village was inaugurated recently. The supply system is the same as that at Bognor Regis and Aldwick, an extension of the 11,000-V main being made from the works of the Bognor Gas and Electricity Co., Ltd., in Argyle Road to a new sub-station erected at Felpham. Mains have also been laid to a sub-station erected at Middleton, and the extension through Yapton to Arundel is nearing completion. The total cost of the extensions is approximately £30,000.

Guildford.—POWER STATION EXTENSIONS.—The Town Council has applied for sanction to a loan of £50,397 for extensions to the Woodbridge power station and plant.

Hull.—ELECTRICITY SUPPLY SCHEME.—The city architect has prepared a preliminary scheme providing for the supply of electricity to the Tidworth Grange estate, the total estimated cost of the installation being £2,210.

IMPROVED BOILER SYSTEM.—At a recent meeting of the Corporation Electricity Committee, the engineer reported that the five new boilers now being erected would be rendered more efficient by the provision of a system of automatic combustion control. He recommended that the "Hagan" patented system of automatic boiler control should be installed, the cost of which would be £3,189. The engineer also reported that it was advisable that the new boilers should be equipped with a re-heated secondary air system, the total cost of the equipment being £900. The recommendations of the engineer were adopted.

Hutton.—INAUGURATION OF SUPPLY.—A supply of electricity was switched on at Hutton, near Weston-super-Mare, on November 7th.

Kettering.—EXTENSION OF SUPPLY AREA.—The Urban District Council has decided to apply for powers to supply electricity to every parish in the area of the Rural District Council. The Urban District Council's powers already cover several of the rural parishes.

Macclesfield.—OVERHEAD LINES.—The Electricity Company of Macclesfield, Ltd., is to erect overhead transmission lines in the Bollington urban district.

Rochdale.—NEW PLANT.—The Corporation Electricity Committee is to recommend the installation of modern turbo-generator plant to replace the existing generating plant at the electricity works.

Rugby.—ELECTRIC FIRES.—The Urban District Council has adopted a suggestion by the electrical engineer to let out on hire electric fires, the charges to be 8s. (including 2s. maintenance costs) per annum for 2-kW fires, and 10s. (including 2s. 6d. maintenance costs) for 3-kW fires.

South Africa.—DURBAN.—The continued increase in the maximum load on the municipal electricity system has caused the borough electrical engineer to recommend the Town Council to approach the Electricity Supply Commission regarding the terms it is prepared to quote for a maximum demand up to the capacity of the Congella station, or otherwise for 30,000 kW, as from the winter of 1932, by which time, at the present rate of growth, the load will, it is estimated, be of the order of 36,000 kW. This course, says the *South African Engineer*, is in conformity with the clause in the agreement between the two bodies which refers to the subject of increased maximum demand over and above that originally decided on. In support of his recommendation the engineer has put forward figures indicating the growth of the undertaking during the last five years. The total revenue for the year ended July 31st last amounted to £426,829, as compared with £259,960 in 1923-24, an increase of 64.2 per cent. The electrical energy sold increased from 41,871,922 kWh in 1923-24 to 80,733,496 kWh (92.8 per cent. rise) in 1928-29, and the maximum supply demanded from 11,155 kW to 26,680 kW (139.3 per cent. rise). The average price obtained per kWh sold fell 17.3 per cent. during the five years from 1.49d. to 1.27d.

Stone (Staffs).—ASSISTED WIRING SCHEME.—The Urban District Council has received sanction to a loan of £2,000 for an assisted wiring scheme.

Torquay.—SPECIAL ORDER.—The Corporation is to apply to the Electricity Commissioners for a Special Order authorising it to extend its area of supply so as to include the urban district of Ivybridge and parts of the rural districts of Kingsbridge and Totnes.

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United States.—Electrical Developments.—Further additions to the power facilities of the Wisconsin-Michigan group of subsidiaries of the North American Company will result from a new steam electric generating plant to be built by the Milwaukee Electric Railway and Light Company at Port Washington, Wis., 28 miles north of Milwaukee. The scheme, says *Power*, involves an initial investment of about $8,000,000, and an ultimate expenditure of more than $25,000,000. Initial installation is planned for a capacity of 60,000 to 75,000 kW, to be increased ultimately to 300,000 kW. The proposed site is on the shore of Lake Michigan, with convenient harbour facilities for coal and water supply. Construction work will begin next spring, contingent upon legislative co-operation by the city of Port Washington. The company also proposes to purchase the Port Washington municipal distribution system and to put into effect domestic and industrial power rates substantially lower than present municipal rates. Growth of industry, particularly on the north side of Milwaukee, is given as the chief reason for increased power facilities. The Port Washington plant will be similar in operating characteristics to the Lakeside plant, which is now being enlarged to bring its capacity up to 310,000 kW. The output of the North American Company's subsidiaries for the twelve months ended September 30th, 1929, was 6,650,000,000 kWh, an increase of 12.6 per cent. over the output for the preceding twelve months.

Negotiations have been completed by the Engineers' Public Service Company for supplying substantially the entire steam and electric power requirements of the large Baton Rouge refinery of the Standard Oil Company, of Louisiana, a subsidiary of the Standard Oil Company, of New Jersey. To meet the terms of the contract, the Louisiana Steam Products, Inc., of Baton Rouge, a newly-formed subsidiary of the Engineers' Company, will build at once a boiler plant capable of supplying the estimated refining plant demand of over 6,000,000,000 lb. of steam a year, and an electric generating plant of 45,000 kW capacity, to cost approximately $6,000,000. The gross business covered by the contract with the Standard Oil Company is estimated to be $1,600,000 annually.

West Lancashire.—Loan.—The Rural District Council is making application for sanction to a loan of £6,015 in connection with a scheme for supplying electric cookers, kettles, and a free wiring scheme.

York.—Mains Extensions.—The Corporation Electricity Committee is to apply for sanction to a loan of £32,000 for mains extensions.

Voltage Increase.—In connection with a scheme to raise the pressure of all new outgoing h.p. feeders from 3,300 V to 6,600 V, the Corporation Electricity Committee recommends the erection of six feeder panels and the building of a small switch house at an estimated cost of £2,720.

Tramway and Railway Notes.

Continental.—Sweden.—The auditors for the State Railways announce that the electrification of the Stockholm-Gothenburg line, which cost in all Kr. 43,300,000, has so far led to a net saving in the cost of running; other advantages obtained through the electrification are greater safety, higher speed of trains and the possibility of increased traffic at a reduced extra cost. The auditors point out, however, that no conclusive judgment on the economic aspect of the electrification can yet be given, and that any opinion as to the result of the electrification of other lines must be withheld. In view of the future necessity of renewing the steam locomotive stock, any possible electrification should preferably be carried out within the next five or six years. The Director-General of the State Railways stated in an interview that the electrification of the main lines next in turn, namely, Stockholm-Malmoe, Katrineholm-Norrkoeping and Falkoeping-Naessjoe, would cost a total of at least Kr. 70,000,000. No proposals for further electrification would be submitted to next year's Riksdag.—*Reuter's Trade Service* (Stockholm).

Hungary.—Two important steps have recently been taken toward the electrification of the main line railway between Budapest and the Austrian frontier. First, the construction of a power plant in Banhida has been commenced, the boiler house of which, with eight boilers, has already been completed. The second step has been the decision as to the electric traction system to be employed, the De Kando split-phase method having been decided upon. The section from Budapest east to Komarom, a distance of about 60 miles, will be provided with a working line for single-phase 50-cycle a.c., two sub-stations being contemplated. Being the most difficult part of the Budapest-frontier main line, this section is intended to be used for testing the fast electric passenger and goods train locomotives ordered by the State Railway authorities from the Ganz Company of Budapest. The results of the tests are expected to furnish the basis for the final large order for electric locomotives.

Italy.—According to figures published in the *Révue Universelle des Transports*, during 1928 the total length of railways operated by electricity in Italy increased from 1,060 to 1,251 km., while there were 883 km. in course of electrification. The number of trains worked by electricity rose from 10 to 13 per cent. of the total number of trains in operation.

A new electric railway running between Ora and Predazzo was opened recently.

India.—Railway Electrification.—The Great Indian Peninsula Railway's main line electrified services between Bombay and Poona were opened on November 5th by Sir Frederick Sykes, the Governor of Bombay. This line which covers a distance of 119 miles, is the first of the main lines in India to be electrified. The Bombay electrified suburban service was inaugurated in February, 1925, and extended shortly afterwards to Kalyan Junction. The newly-opened section is from Kalyan to Poona. The train used for the inauguration ceremony was drawn by one of the twenty-two new 2,160-h.p. electric locomotives which are being supplied by the Metropolitan-Vickers Electrical Co., Ltd. Forty-one electric freight engines, each weighing 120 tons and equipped with motors totalling 2,600 h.p., have also been supplied by this company.

Leeds.—New Tramway Route.—The Corporation Tramways Committee has decided to apply for powers authorising the construction of a tramway from Great Wilson Street to the junction of Meadow Lane and Dewsbury Road.

London.—Underground Railways' Works Programme.—The programme of works which was submitted to the Government by the Underground Group of Companies, involving a proposed expenditure of £13,000,000, and was referred to by the Lord Privy Seal in the House of Commons on November 4th, included the following:—(i) The extension of the London Electric Railway northwards from Finsbury Park to Cockfosters, a mile north of East Barnet, a distance of 7½ miles with seven stations. (ii) The extension of the London Electric Railway westwards from Hammersmith to Northfields, involving the construction of two additional tracks parallel to the existing tracks of the Metropolitan District Railway. (iii) The complete reconstruction of Leicester Square station on the same general plan as the new station at Piccadilly Circus. (iv) The construction of an interchange between Holborn station of the London Electric Railway and British Museum station on the Central London Railway by means of escalators. (v) The reconstruction of Dover Street, Hyde Park Corner and Knightsbridge stations. (vi) The provision of escalators and other improvements at twelve additional stations.

Tramway Cable Extensions.—The London County Council Highways Committee recommends the approval of an estimate of £58,700 in respect of the supplementation and extension of the tramway electric cable system.

Telegraph and Telephone Notes.

Portugal.—Telegraph Rates.—The commercial and industrial associtations throughout the country have urged upon the government the necessity of reducing the telegraph rates. *Reuter's* (Lisbon).

The Telephone Service.—Birmingham Automatic Exchanges.—A further preliminary step in the introduction of automatic telephones in Birmingham took place on November 2nd by the transference of over 500 Central and Northern subscribers to the Aston Cross exchange, and 300 Midland subscribers to the Calthorpe exchange.

Rural Telephones.—The Postmaster-General has informed a deputation of the National Farmers' Union of Scotland that he will give sympathetic consideration to the fixing of a flat rate for all installations within a three-mile radius from an exchange, and for the extension of the radius when and as circumstances permit.

The deputation urged that the success of any scheme for the development of rural telephones would depend upon rural subscribers paying according to the use they made of the telephones, and not according to their distance from the exchange.

Trunk Traffic.—The total number of telephone stations in the British Post Office system on August 31st, 1929, was 1,803,927, a net increase for the month of 9,503. London's share of the total was 644,440, an increase of 2,780 for the month, of which 154,943 were residence-rate subscribers (month's increase, 779) and 5,702 were call-office stations, including 1,422 kiosks. The provinces claimed 1,159,487 of the total, the increase for the month being 6,723, of which 245,578 were residence-rate subscribers (month's increase, 1,931) and 22,451 call-office stations, including 5,548 kiosks. The total number of inland trunk calls dealt with during June, 1929, was 9,670,669, representing an increase of 456,632, or 5 per cent., over the total for the corresponding month of the previous year.

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Radio Notes.

Loud-speakers.—RESPONSE CURVES.—Last week's paper before the I.E.E., descriptive of the analysis and measurement of the noise emitted by machinery, should be of some assistance to radio engineers. For instance, the Metropolitan-Vickers Electrical Co.'s sound-measuring apparatus and "noise" laboratory were developed primarily for testing machines, but the following example illustrates the application of the methods and technique to another useful purpose. The comparison of loud-speakers in the past, as regards sensitivity and type of response curve, has been largely a matter of opinion, but it is easy with the apparatus described in the paper to measure the response of any loud-speaker in a sensibly non-reflecting room at all important frequencies and to give the answer in absolute units. The curve of response against frequency (for the attracted-diaphragm type of loud-speaker tested) then provides a definite fundamental basis for comparison. There is very little doubt that, in a year or two when people have been educated to the sight of the utterly inadequate curves of their favourite loud-speakers, the makers of the better-class instruments will publish response curves just as the intervalve transformer manufacturers have done recently. The fact that the loud-speaker tested would satisfy a large proportion of listeners is a striking testimony to the adaptability of the ear. Notes in the lower half of the piano range are heard largely as harmonics, the ear subconsciously supplying the diminished or absent fundamentals. It is also interesting to note that when the loud-speaker was supplied with 50-cycle currents no output at that frequency could be detected, but, dué to non-linearity, frequencies of 100 and 150 were generated and could be detected. If preferred, of course, the test could be made in conjunction with a particular loud-speaker valve, but in the present example a constant current of 1.6 mA was maintained in the operating coils.

Regional Stations.—SERVICE AREAS.—Prominent among the new features of the B.B.C. "Year Book," 1929, is a summary of the progress that has been made with the regional scheme. It is stated that the second programme from Brookman's Park will at first be of short duration and late at night. The northern regional transmitter will use the longest medium wave of all the regional transmitters, and its service area will be greater than that of the London station; it will use three 500-ft. masts and two aerials. The regional stations of Daventry, London, and Manchester will cover about 75 per cent. of the population of the British Isles with a service of alternative programmes. The Scottish regional station (based on Edinburgh and Glasgow) and the west regional station (based on Cardiff, Swansea, and Bristol) will cover the remaining 25 per cent. It is estimated that two years and a-half will elapse before the scheme is completed and in working order.

Relay to Canada.—BEAM TELEPHONY.—The British Broadcasting Corporation's broadcast of the November 11th service at the Cenotaph was successfully relayed by beam telephony to Canada and rebroadcast by a chain of stations throughout the Dominion. In addition to being transmitted by all the B.B.C. stations, the microphones in Whitehall were connected by Post Office landline to the Imperial and International Communications Company's short-wave beam station at Bodmin; thence the ceremony was transmitted by the Marconi-Mathieu multiplex system of telephony to the Canadian Marconi Company's beam receiving station at Yamachiche, near Montreal, which in turn passed it on to the broadcasting stations of the Canadian National Railways. The wavelength employed on the multiplex beam link across the Atlantic was 16.575 metres, the arrangements being similar to those made on July 7th for the relay of the thanksgiving service in Westminster Abbey, which was broadcast throughout Canada by the same means.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—December 10th. Posts and Telegraphs Department. Switchboard keys and parts. (B.X. 5776.)* Electric lamps, lamp caps, and lamp sockets for telephony purposes. (B.X. 5783.)*

December 17th. Telephone fuses, heat coils, and protectors. (B.X. 5784.)* Loading-coil pots. (B.X. 5785.)* Secondary batteries. (B.X. 5777.)*

January 7th. Telephone hand sets. (B.X. 5823.)* Contact pressure testers. (B.X. 5821.)*

January 14th. Ringing motor-generator sets for automatic telephone exchanges. (B.X. 5839.)* Telephone indicators. (B.X. 5822.)*

November 27th. Victorian Government Railways. Indication transformers for railway signalling, with a no-load ratio of 100/6 V. (B.X. 5737.)*

March 30th.—D.c. neutral relays for power-signalling purposes. (B.X. 5793.)*

December 9th.—State Electricity Commission of Victoria. 3,000-kVA transformers and spares. (B.X. 5775.)*

January 13th, 1930. 2,200-V switchgear and accessories. (B.X. 5827.)*

SYDNEY.—December 16th. Public Works Department. Electrically-driven pumping set for the Junce water supply. (A.X. 8740.)*

Colwyn Bay.—November 16th. Urban District Council. Supply, erection and laying of e.h.p. and l.p. overhead lines and cables in connection with the Glan Conway and Llysfaen electricity supply. (November 8th.)

Dublin.—November 21st. Dublin Port and Docks Board. Twelve months' electrical supplies. Mr. E. H. Bailey, secretary, Port and Docks Office, Westmoreland Street, Dublin.

Egypt.—CAIRO.—November 30th. Ministry of the Interior. Diesel engine-driven electric lighting installation at Abou-Tig (Assiut Province). (B.X. 5791.)*

December 28th. Ministry of Public Works. Electric generating and pumping sets for Mankabad Barracks. (B.X. 5842.)*

Fife.—November 20th. Education Authority. Electrical work at reconstructed Cowdenbeath School. Schedules (£1 1s. deposit) from Mr. George Sandilands, architect and master of works, Education Offices, Kircaldy.

Glasgow.—November 18th. Corporation. Electric lighting installation at Janefield Street re-housing scheme and at Shieldhall Hospital. Specifications from General Manager, 75, Waterloo Street.

Holywood, Co. Down.—November 21st. Urban District Council. Supply of 24 steel lighting standards. (See this issue.)

India.—November 22nd. South Indian Railway Co., Ltd. Madras electrification. Switchgear for stations (lighting, power, and signalling). (November 8th.)

November 21st. H.d. bare solid copper conductors for overhead power transmission for 12 months. (A.X. 8759.)*

Lancaster.—November 16th. Electricity Department. Supply of medium-pressure 4-core, paper-insulated, l.c. steel tape armoured cables. (November 8th.)

London.—HANWELL.—November 23rd. Managers of the Central London School District. Motor with reduction gearing, starter, &c. (November 1st.)

STEPNEY.—December 5th. Board of Guardians. Installation of wireless receiving apparatus at each of its three hospitals. The apparatus required will include 1,159 headphones and 24 loud-speakers. (See this issue.)

COMMISSIONERS OF H.M. WORKS, &C.—November 28th. H.p. and l.p. switchgear, transformer and cables at H.M. Office of Works generating station, South Kensington. (See this issue.)

New Zealand.—WELLINGTON.—March 11th. Public Works Department. 110-kV switchgear for interconnection auto-transformers for the Waikato power scheme. (B.X. 5797).* Switchgear and controlling equipment for Timaru. (B.X. 5798.)* 66-kV switchgear and protective system for Lyttleton, Lake Coleridge scheme. (B.X. 5796.)*

Post and Telegraph Department. January 13th, 1930. Four point jacks. (B.X. 5840.)*

November 12th. V.i.r. cable. (B.X. 5826.)*

CHRISTCHURCH.—November 23rd. City Council. Pump and electric motor. (A.X. 8737.)*

Salford.—November 25th. Corporation. Electric travelling and slewing jib crane. (November 8th.)

South Africa.—BLOEMFONTEIN.—December 2nd. Waterworks Department. Two low-lift and two high-lift electrically-driven pumping units, with cables, starters, &c. (A.X. 8710.)

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December 2nd. Municipal Council. Copper conductors, poles, transformers, and switchgear. (B.X. 5825.)*

Pretoria.—December 27th. Posts and Telegraph Department. Telegraph material. (A.X. 8734.)*

Catooma, Rhodesia.—December 12th. Municipal Council. Two boilers, steam engines, alternators and switchboard. (A.X. 8749.)*

Stockport. — December 2nd. Electricity Department. Supply, delivery and erection of 6,600-V switchgear. (November 8th.)

Stone.—November 25th. Electricity Department. E.h.p. overhead 11,000-V transmission line (2,300 yd.); two 50-kVA sub-stations, and l.p. overhead distribution services (1,400 yd.), &c. (November 8th.)

Warrington.—November 18th. Electricity Department. E.h.p. sub-station switchgear. (November 1st.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Brighton.—Lighting Committee. Accepted :—
Lamps for street lighting for 12 months.—Edison Swan Electric Co., Ltd.

Fylde.—Board of Guardians. Accepted :—
Wiring for electric lighting the Children's Homes at Kirkham (£224).—Darbyshire, Ltd.

Hastings.—Electricity Committee. Recommended :—
375-kVA transformer (£303).—Ferranti, Ltd.

Leeds.—Electricity Committee. Accepted :—
Cables (£1,296).—W. T. Henley's Telegraph Works Co., Ltd.; (£1,849) Macintosh Cable Co., Ltd.; and (£1,325) Enfield Cable Works, Ltd.
Electric lift for boiler house (£661).—Pickering, Ltd.

London.—Metropolitan Asylums Board.—Installation of central battery telephone system at South West Hospital :—

Ericsson Telephones, Ltd. (recommended) ...	£437
Tate, L. G., & Co., Ltd.	492
Clarke, T., & Co., Ltd.	493
Alpha Manufacturing & Electrical Co., Ltd. ...	523
General Installation Co., Ltd.	525
Phillips & Sons (Chiswick), Ltd.	890

Great Western Railway.—Accepted :—
18 months' supply of gasfilled electric lamps.—Siemens Electric Lamps & Supplies, Ltd.

Westminster.—Housing Committee.
Installation of time switches at Admiral House and Schomberg House, and staircase electrical installation at Marshall Street dwellings.—Gaillard, Robinson & Co.

Sheffield.—Health Committee. Recommended :—
Maintenance of internal telephone systems at hospitals for 12 months (£60).—T. A. Ashton, Ltd.
Tramways Committee.
Ten car sets of traction motors (£200 each).—Metropolitan-Vickers Electrical Co., Ltd. (Accepted.)
500 street tramcar tires.—Brown Bayley's Steel Works, Ltd. (Recommended.)

Sleaford.—Electricity Committee. Recommended :—
Feeder control panel and switchgear (£113).—General Electric Co., Ltd.

Forthcoming Events.

British Electrical Development Association.—Friday, November 15th. Royal Society of Arts, Adelphi, W.C.2. 7.30 p.m. "Selling Time Switches." Mr. E. E. Sharp.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, November 16th. South Wales Institute of Engineers, Cardiff. 6 p.m. "Electrical Measuring Instruments." Mr. R. H. Morgan.

Public Works, Roads & Transport Exhibition.—November 18th-23rd. Royal Agricultural Hall, N.

Institution of the Rubber Industry.—Monday, November 18th. Engineers' Club, Coventry Street, W. 6.45 p.m. Annual meeting.

Association of Supervising Electrical Engineers.—Tuesday, November 19th. Junior Institution of Engineers, 39, Victoria Street, S.W. "Development of Generation and Distribution of Electric Power in the British Isles." Mr. A. Page.

British Electrical & Allied Manufacturers' Association.—Wednesday, November 20th. Connaught Rooms. Annual dinner.

Overhead Lines Association.—Wednesday, November 20th. Institution of Electrical Engineers, Savoy Place, W.C.2. 5.30 p.m. "Standard Intermediate Voltages for Rural Electrification." Mr. R. Borlase Matthews.

Edinburgh Electrical Society.—Wednesday, November 20th. 16, Royal Terrace. "Street Lighting." Mr. W. Millar.

Institution of Electrical Engineers.—Thursday, November 21st. Institution, Savoy Place, W.C.2. 6 p.m. Joint meeting with the Institute of Fuel. Discussion on "Low Temperature Carbonisation of Fuel with special reference to its combination with the production of Electricity." Introductory papers by Messrs. E. H. Smythe, E. G. Weeks, S. McEwen, and Dr. Ing. P. Rosen.

(Mersey & North Wales (Liverpool) Centre).—Monday, November 18th. The University, Liverpool. 7 p.m. "The Theory and Practice of Modern Loud-Speakers." Dr. N. W. McLachlan.

(Scottish Students' Section).—Tuesday, November 19th. Heriot-Watt College, Edinburgh. 7.15 p.m. "Recent Hydraulic Developments in Hydro-Electric Stations." Mr. J. B. Todd.

(North-Western Centre).—Tuesday, November 19th. Midland Hotel, Manchester. Annual dinner.

(Hampshire Sub-Centre).—Thursday, November 21st. University College, Southampton. 7.30 p.m. "Illuminating Engineering." Dr. J. W. T. Walsh.

(Sheffield Sub-Centre).—Wednesday, November 20th. Royal Victoria Hotel, Sheffield. 7.30 p.m. "Organised Scientific Research and Engineering Progress." Mr. A. Tustin.

(Tees-Side Sub-Centre).—Wednesday, November 20th. Cleveland Technical Institute. 7 p.m. Ordinary meeting.

(North-Western Centre, Students' Section).—Saturday, November 23rd. Manchester. Dance.

(North-Eastern Centre, Students' Section).—Friday, November 22nd. Grand Assembly Rooms, Barras Bridge. Annual dance.

Physical Society.—Friday, November 22nd. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

Birmingham Electric Club.—Friday, November 22nd. Grand Hotel, Birmingham. 7 p.m. "Dust Explosions." Mr. J. D. Morgan.

Electrical Power Engineers' Association (Kent Section).—Saturday, November 23rd. Royal Star Hotel, Maidstone. 6 for 6.30 p.m. Annual dinner.

(Manchester Local Technical Group).—Wednesday, November 20th. Geographical Hall, Deansgate, Manchester. 7 p.m. "Hire and Hire-Purchase of Electrical Apparatus." Mr. D. J. Bolton.

(Birmingham Local Technical Group).—Tuesday, November 19th. Chamber of Commerce, Birmingham. 7 p.m. "Synthetic Insulation." Mr. M. Rowell.

(Liverpool Industrial Section).—Saturday, November 23rd. Bear's Paw Café, Liverpool. Annual dinner.

(Derby Section).—Saturday, November 23rd. Black Boy Hotel, Nottingham. 6.45 p.m. Annual dinner.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of makers of the following :—

Bristow coils, suitable for use in a cripples' clinic.
Munzing clips.
"Strait & Richards" electric log fires.
Firms who do the actual colouring of electric lamps.

Aerial Cableway at Chamonix.

An aerial cableway for the transport of passengers has recently been put into service between Chamonix and Planpraz, the first section in the ascent of the Brévent. Besides this cableway there is only one other in existence in France, that of the Aiguille du Midi, for the transport of passengers. The one between Chamonix and Planpraz starts at an altitude of 1,100 m. and reaches its terminus at 2,062 m. It is supported on six pylons in reinforced concrete, of which the highest is 33 m. high. The greatest span is 552 m. The supporting cable is 64 mm. in diameter and has a resistance of about 270 tons. The hauling cable passes over pulleys 3.5 m. in diameter, and is attached to the two carriages, which balance one another, and accommodate 30 passengers each. This cable is operated by electric motors at a speed of 3 m. per second. The two carriages are also connected in the rear by another cable which passes over pulleys situated in the lower station. An emergency cable is also provided with automatic brakes, and this cable may serve to return the carriages to their points of departure should normal operation be interrupted.

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Notes.

Batti-Wallahs' Society Luncheon.

Mr. H L. Howard presided over a gathering of some 180 members and guests at the luncheon held on November 7th at the Hotel Cecil. The chief guest was Mr. Frank Hodges, J.P., who addressed the gathering on the subject of the electricity supply industry. Mr. Hodges said that the increase in the use of electricity and gas and of fuel-saving appliances had not resulted in a reduction of the total coal consumption in the country. The falling-off in coal output had been due to loss of export trade. The use of electricity, in fact, stimulated other process work requiring coal. Referring to the recent manifesto by the South Yorkshire Coal Owners' Association, Mr. Hodges stated that if it were shown that electricity could be provided by the coal owners more cheaply than the grid scheme, the Central Electricity Board would not be displeased and would take a supply. The electrical industry, as an expanding industry, would find work for those leaving school and those who prevented the Board getting on with its work made the solution of the unemployment problem more difficult. Our country was not merely a museum for archaic beautiful things. Modern works were not necessarily ugly; many, such as electric power stations, seemed to him to have a beauty of their own in expressing the purposeful will of man. Regarding fume emission from power stations, the technicians who had brought the industry to its present healthy condition could be trusted to surmount all difficulties. The vote of thanks to Mr. Hodges was proposed by Mr. W. McLelland, C.B., O.B.E.

The next luncheon of the Society will be held at the Hotel Cecil on December 5th, when Mr. V. Watlington, M.B.E., M.I.E.E., will deliver an address. It is announced that Mr George Balfour, M.P., M.I.E.E., has been elected a Batti-Wallah.

Mr. Marryat's Appeal.

We welcome the following letter received from Mr. H. Marryat, president of the Electrical Trades Benevolent Institution, whose appeal for substantial help for the Fund appeared in the Electrical Review for October 25th.

"I wish to express my gratitude to you and other members of the technical Press for the enthusiastic support which has been given to my appeal on behalf of the Electrical Trades Benevolent Institution.

"You will be glad to hear that donations of £500 or over have been made by:—

Sir Hugo Hirst, for the G.E.C.,
Mr. Frankenburg, Greengate & Irwell Cable Co.,
Messrs. Merz & McLellan,
Mr. J. A. Crabtree,
Sir George Sutton,
Mr. Dane Sinclair,
Sir T. O. Callender,

and other large cheques have been received. In addition a very great number of regular subscribers have kindly increased their subscription.

"We are now only requiring some £7,000 to enable the Institution to face the new year in security, with a capital of £50,000. I shall be very glad to hear from any of your readers willing to assist in making up this sum. Any contributions from 5s. upwards will be most gratefully received.

"The Festival Dinner and Dance will be held at the Savoy Hotel on November 26th. The tickets are 25s. each, from the Secretary, Captain Keeping, 9, Southampton Street, Holborn, W.C. I hope that as many of your readers as possibly can will accept this opportunity of giving themselves and their ladies a first class treat, and of helping the E.T.B.I. at the same time.

H. Marryat."

London, *November 12th*, 1929.

Electricity and Gas.

Mr. A. R. Myhill, A.I.C., of the central laboratory of the Birmingham gas works, in his presidential address to the Midland Junior Gas Association, stated that it was idle to say that cheap electricity would close down gas works. The experience was that the gas industry was making remarkable progress concurrent with electrical development; no one form of energy could claim a monopoly, and the conclusion was being gradually arrived at that the amalgamation of resources must take place. On the manufacturing side they saw gas works producing coke and breeze in excess of their requirements, which products could be used for the production of electricity, or the distillation of liquid fuel. There were electrical undertakings which made oil and tar that could be used either directly as fuel, or indirectly as gas-making materials; in such cases the pooling of resources would result in a great reduction in costs. The time was not so far distant when the supply of gas and electricity would be run as sections of one great industry, comprising the output of all forms of energy, not excepting that provided by solid and liquid fuels. There was a tremendous future for gas for industrial purposes, and in street and outside illumination there was great scope for expansion, the competition from electricity being much less serious than was the case with regard to domestic lighting.

Sulphur impurities provided ample scope for the works' chemist. No process for the complete removal of sulphur had yet been so successful as to justify its adoption on the large scale as a matter of general practice, although good work was being carried out, but the installation in gasworks of processes for the complete removal of sulphur from gas would become a necessity and the established practice of the future. An excessively large quantity of sulphuretted hydrogen had to be dealt with, and the liquid purification processes at work had not provided a satisfactory solution of the problem in this country. The sodium-carbonate process was working well in America, but it possessed the great disadvantage that the sulphur of the gas had to be eventually discharged into the air, either as H_2S or SO_2, a practice which would never be tolerated in this country. There seemed no reason to suppose that the process was incapable of modification so as to make it usable in Great Britain. Its introduction, besides serving as a means of economically removing sulphuretted hydrogen, would result in the simultaneous extraction of cyanogen and the consequent lessening of corrosion troubles.

Water and Steam.

Until recently the properties of water and steam at high temperatures and pressures have been mainly speculative, based on the law of "corresponding states," which has proved to be a somewhat unreliable guide. Actual measurements of heat quantities, or even of densities, at temperatures between 700 and 800 deg. F. and pressures between 3,000 and 4,000 lb. per sq. in. were so difficult and expensive as to discourage the purely scientific investigator. Recently, with the collaboration of the engineering institutions and research laboratories, considerable progress has been made in various countries towards the solution of this important problem, a remarkable degree of agreement has already been reached, and it may be hoped that something of practical value as well as of scientific interest may shortly result. It would be very rash at the present stage to make any attempt to forecast the possible practical applications of the knowledge thus gained, which is essentially a problem for engineers. Accordingly in the sixteenth Thomas Hawksley Lecture before the Institution of Mechanical Engineers Prof. H. L. Callendar devoted his remarks chiefly to the bearing of the experimental results on the theory of the relations between liquid and vapour, which fall naturally within the province of the physicist.

Appointments Vacant.

Meter tester and repairer for Hove Electricity Department. Lecturer in electrical engineering at the Government Technical Institute, Insein, Burma. Assistant engineer for the Meter and Consumers' Installation Department for Sunderland Corporation. Mains assistant for Nelson Corporation. Assistant electrical engineer for the Government of Sierra Leone. Installation and consumers' assistant for the Winchester Electricity Department. Electrical engineer for the L.C.C. Tramways Department. Assistant lecturers in electrical engineering and commercial subjects at the Municipal College of Technology, Belfast. (See our advertisement pages to-day.)

E.P.E.A. Dinner.

The seventh annual dinner of the West Yorkshire Section of the Electrical Power Engineers' Association was held on Saturday, November 2nd, at the Great Northern Hotel, Leeds, Mr. R. Toynbee presiding. In proposing the "Association," Alderman Ben Turner, M.P., Minister for Mines, said that he looked to the electrical industry coming forward and doing its fair share towards the relief of the deplorable conditions which existed in the coal-mining areas. The work of the Central Electricity Board would bring changes for the well-being of the nation, and it was imperative that not a single member of the electrical trade should suffer on that account.

Mr. T. D. Martin, A.M.I.E.E., president of the Association, responded, saying their own particular industry to-day was one of the most prosperous in every branch, and if similar scientific methods were applied in the coal industry, *e.g.*, by the installation and application of more electrical machinery, output could be increased and production considerably cheapened. During the past year their Association had been very busy with the schedule. They had always stood for peace within industry, but there were still some municipal bodies which did not fully realise how that very vital scheme was worked.

The Lord Mayor of Leeds (Ald. D. B. Foster) said that, whilst he did not wish to see the beauty of this country interfered with more than necessary, it might be essential to encroach in a small way at given places. In Leeds, since the introduction of assisted wiring, large numbers of people were having electricity installed in their homes.

Mr. J. N. Waite, M.I.E.E., city electrical engineer, Kingston-upon-Hull, in response, said that electric lighting was one of the best methods of attracting trade. The problem of cheap distribution would have to be given very serious consideration before they could expect electricity to be more generally adopted. They must also learn to sell their commodity, and not wait until people came along to ask for it. The complete electrically-equipped house was a matter of time only.

Ald. J. W. Longley, M.I.Mech.E., chairman of the Bradford City Electricity Committee and No. 2 District Joint Board, said that the National and District Joint Boards were to a large extent responsible for the success of the electricity undertakings. He had had something to do with the drafting of the schedules. The District Boards did their work so well

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that the national body could devote a great portion of its time to the larger matters of interest to the industry. Although stations were to be closed down, distribution would be increased, and engineers might reasonably look forward to not less, but increased employment, once the Government scheme was in full operation. The Joint Industrial Councils were often called "Whitley Councils," but in their own industry they should be termed "Walker Councils."

Mr. A. V. Sendell, senior vice-president, responded, and said that in the conference between employer and employé the success of their own as well as other industries lay.

Mr. R. McCourt proposed "The Ladies and Guests," to which Mr. J. W. Thomas, LL.B., B.Sc., A.M.I.E.E., responded.

Tokio Engineering Congress.

The somewhat adventurous courage of Japanese engineers in inviting to Tokio the first World Engineering Conference, which closed on November 7th, has, in the opinion of the leading British and American delegates, been justified. According to *The Times*, the visitors are returning well satisfied with the results of their voyage, delighted with their reception, and impressed by the vigour, enterprise, and engineering progress they have seen. The organisation was efficient, the language difficulty was well handled, and the proceedings went smoothly and expeditiously. Eight hundred engineering papers were presented and, although their number makes an evaluation of the work of the conference impossible at present, it is agreed that the collection of papers, expounding the latest practice in every country and in all departments of engineering, reached at its best a remarkably high level. The sectional discussions, in spite of the pressure of time, were much valued by local engineers. Japanese engineers attended in the proportion of four to one, and contributed a number of valuable papers.

A sectional meeting of the World Power Conference, which was held simultaneously, being smaller, maintained the highest standard throughout, and the papers read were uniformly valuable, and the discussions more thorough.

According to *Reuter's* agency, prior to the closing ceremony a general meeting of the Congress passed a number of resolutions, including one recommending the appointment of a preparatory committee, composed of prominent engineers from all the leading countries, for the purpose of organising a World Engineering Federation.

Mining Apparatus in Service.

Photographs of electrical apparatus in actual service in mines are not readily obtainable, and for that reason the accompanying illustrations of a flameproof air-break circuit breaker and an armoured-cable coupling are of particular interest. The photographs were taken in a Midland colliery. Both the breaker and the coupling were made by George Ellison, Ltd., whose photographer succeeded in getting the pictures with the help of the colliery engineer, who went to some trouble in rigging up a temporary lighting circuit to illuminate the breaker and grouped several miners' lamps around the cable coupling. Two of the miners' lamps appear in the second picture, and it is interesting from a photographer's point of view that the halation which might have resulted from those lamps being in front of the camera was overcome because the exposure of the negative was necessarily a long one. The circuit breaker is of the standard

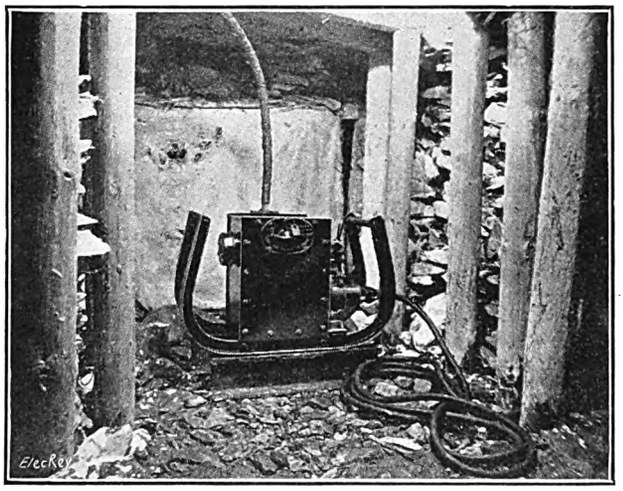

Fig. 1.—Gate-end Circuit Breaker.

"Ellison" magnetic blow-out, air-break type, enclosed in a welded-steel flameproof box on skids for use at the colliery gate and where a trailing cable connection is required for operating coal cutters, conveyors, and loaders. The supply cable to the circuit breaker is fitted with a detachable sealed end, which is bolted to an adaptor on the breaker and connected to its terminals by means of removable links. When the mine working necessitates a move forward, the cable is detached and the breaker dragged to the new position. The sealed end of the cable then forms half a coupling, and a new length of cable with its ends similarly prepared is laid in place with one end attached to the breaker and the other end bolted up and linked to the cable, which was laid up to the old position. The two cable ends thus form a workmanlike joint when the cover is bolted over the links and the two halves of the coupling are bonded to secure the electrical continuity of the cable armouring. This cable-end coupling is an "Ellison" patent, and is already used in many mines, where it is appreciated that the device saves

Fig. 2.—Armoured-cable Coupling.

time and labour and does not require the use of a blow lamp or liquid bitumen to make and seal the joint.

Inquiry at Southend-on-Sea.

An inquiry was held on November 6th and 7th at the Municipal Buildings, Southend-on-Sea, by Col. T. C. Ekin, inspector of the Electricity Commissioners, into the application of the Corporation for sanction to a loan of £66,000 to cover the cost of, and for consent to, the installation of three 1,200-kW Diesel sets to replace existing plant. The application was opposed by the Central Electricity Board. Mr. S. Turner, in presenting the case for the Corporation, said that the present plant was overtaxed and the Corporation was obliged to discourage the use of electricity. He gave figures showing that during the year 1928-29 the maximum load reached 8,122 kW, leaving a surplus of only 68 kW. For the present year, with a bulk supply available from the County of London Electric Supply Co., the surplus was estimated at 250 kW, without spares, but under the agreement with the County of London Company there were duplicate lines of 1,800 kVA, so that the second line was available as a spare. For 1931 the maximum load was estimated at 10,500 kW. The three solutions to the problem considered by the Corporation were: (1) an additional supply from the County of London Company; (2) a supply might become available from the Central Board; (3) extension of the station for certain additional plant. The scheme proposed in the application was chosen, as it was estimated that approximately £15,000 would be saved by that scheme. Mr. A. C. Johnson, acting borough electrical engineer, said the manufacturers stated that they could have the first engine running within 3½ months, the second three months later, and the third seven months later. Mr. H. Hobson, supply engineer to the Central Board, said he was satisfied that the proposal of the Corporation would involve the Board in unnecessary expense. If carried out, it was likely to prevent Southend from receiving the full benefits accruing to it under the South-Eastern England scheme. He was authorised to state that the supply from the Central Board would be available by the autumn of 1931, and he guaranteed that the price for four years would be £3 5s. per kW and 0.2d. per kWh, although the fixed grid price would not be known, as the South-Eastern scheme had yet, in large part, to be carried out. If, however, the grid price became operative at a lower rate before the end of the four years, Southend would have the option of receiving the benefit of the lower price. Referring to the four years' guaranteed price of £3 5s. per kW, he calculated that the saving to Southend would be £2,276 in the first year, £1,627 in the second, £401 in the third, and £50 in the fourth, making a total of £4,354.

The Commissioners will give their decision in due course.

The Electricity Supply Rifle League.

As the result of recent matches between teams in the above league, City A leads in the first division with 12 points, followed by Central A as second with 8 points. The leading team in the second division is St. James' with 23 points, followed by City C with 17 points.

The Electrical Association for Women.

Some interesting details regarding the Exe Valley electricity scheme were forthcoming at the inaugural meeting at Exeter on October 24th of the East Devon branch of the Electrical

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Association for Women. Mrs. J. M. Phillips, of Honiton, presided, and in welcoming the visitors Mr. Arthur E. Brock, chairman of the Exeter Electricity Committee, remarked that as the Exeter Corporation was the largest producer of electricity in that part of the country, it was naturally interested in any movement to increase consumption. Mr. S. A. Grant, representing the Exe Valley Electricity Company, in outlining the new scheme for that valley and the East Devon area, for the initial inception of which he gave the credit largely to Miss Partridge and Dr. Purves, said that only within the past few months had it been possible to give the scheme practical form. They had received the goodwill of landowners and farmers, and it had been unnecessary to resort to compulsory powers to obtain wayleaves for the transmission lines. Recently there had been much talk in the public Press of electric wires and standards spoiling the amenities of the countryside, and it was astounding to find how ill-informed and exaggerated much of it was. The general idea of the scheme was to take a bulk supply of electricity from the Exeter Corporation to a point near Sowton, and to transmit it as far as Wellington and Wiveliscombe in the north, and Exmouth and Sidmouth in the south, radiating secondary lines to supply other towns and villages in the area of supply. The company hoped to have a network for rural distribution, by which farms and isolated hamlets would be served. The company would sell power on terms that would make its employment practicable for domestic heating and cooking and for the multifarious uses of farming and industry.

Miss C. Haslett, director, said it was very opportune that a branch should be formed in Devon, where there were such big movements on foot for the electrification of rural areas. Though housekeeping was probably the oldest industry in the world, some of the tools which women were using were among the most primitive. It was strange that to-day, when television was a practical proposition, when we were contemplating flying at four hundred miles an hour, and scientific developments were taking place everywhere, women were still employing antiquated methods in their homes. Electricity was the great force that would emancipate women from the drudgery of the home, and the Association had been formed as an expression of the revolt of women against the old methods. There were now 17 branches of the Association, which had no commercial interests, but nevertheless worked in very close co-operation with electrical engineers.

Mrs. Wintringham, J.P., formerly M.P. for Louth, said the Association was to be congratulated on specialising on the question of rural electrification.

Miss M. Partridge, B.Sc., A.M.I.E.E., moved a resolution that an East Devon branch be formed and a Council elected, with Mrs. Phillips as president, and Miss Binney (Torquay) and Miss Wilson (Exeter) as local honorary secretaries. The resolution was seconded by Mrs. Brock, and carried.

A successful social evening was spent in the Association's London club room on October 23rd, when some interesting films were shown dealing with the conferences of last summer; the I.M.E.A. Convention, taken by Col. Vignoles, and the E.A.W. Newcastle Conference and the W.E.S. Conference at Bedford College, taken by Mrs. Llewelyn B. Atkinson, were much appreciated, as also were "family" films by Mrs. Atkinson.

At the request of the Women's Institute, Wooten-under-Edge, a lecture by Miss M. Partridge was arranged recently by the E.A.W. on the "Economic Aspect of Electricity in the Home."

On November 7th a lecture on "Electric Light and Eyesight Preservation" was given by Mr. W. J. Jones, M.Sc.(Eng.), A.M.I.E.E., to a large London audience.

How electrical science is employed to fight disease was demonstrated to a party of seventy members of the Cardiff branch of the Association who visited the City Lodge Hospital at Cardiff on November 5th.

The Birmingham and Midlands Branch of the Association, which is now half-way through its autumn programme, has had exceptionally well attended meetings and crowded demonstrations, including a discussion on electricity in schools; lectures on "Modern Tendencies in Architecture, Furnishing and Lighting Designs and the part Electricity plays therein," by Mr. Francis; lecture on "Supply Undertakings and the Domestic Consumer," by Mr. E. J. Jennings; and three demonstrations of "Household Electrical Equipment." The membership of the branch is still steadily increasing.

Institution Notes.

Institution of Electrical Engineers.

Informal Meeting.—The informal meeting held on November 4th was for the purpose of a discussion on "Paris and the Pyrenees: notes on some of the Technical Features of the I.E.E. 1929 Visit," opened by Mr. R. Borlase Matthews, with Mr. J. R. Bedford in the chair. A large assembly included many of the ladies and members who visited France last June, who saw a splendid series of epidiascope illustrations from an assortment of excellent snapshots and kinematograph films taken by members of the party. The technical aspect did not predominate in the views, for the mountains and old Carcassonne naturally appealed most to the picture takers, but a wide survey of all the generating stations of Paris was made, and Mr. Borlase Matthews had a number of detailed drawings of the boiler plant at Ivry. Among his remarks upon the Pyrenees section of the tour, Mr. Borlase Matthews said that possibly the most instructive part of the whole trip was the reason for the existence of the electro-chemical and electrolytic works that were visited. However interesting they were in themselves, the all-important point of their being was that they were employed as load levellers. Their very existence made the hydro-electric system a commercial success, for a load factor of nearly 95 per cent. was obtained. The means whereby that desirable end was attained was largely tactful organisation. Apart from the fluctuating demands on the average generating stations during winter and summer and during night and day, throughout the Pyrenees water shortage had also to be faced twice yearly—in February and in August. To combat inconvenience on that score, a common-sense arrangement was made with various manufacturing firms whereby their consumption was regulated according to the season of the year and the time of the day. Manufacturing concerns, usually of a chemical nature, when operated in that way were of the highest value to electric power supply undertakings. In the whole of France in 1926 out of 4,562,262,000 hydro-electrically generated kWh sold, 611,518,000 kWh were utilised in chemical and electro-metallurgical works; hence that class of consumption was nowadays a very important fraction of the whole output (about 13.4 per cent.). All the systems of the generating companies (including the Midi Railway Co.) were interconnected electrically and controlled through a central organisation known as l'Union des Producteurs d'Electricité des Pyrenees Occidentales, a "load-dispatcher" being located at Tarbes. The works must at all times absorb any surplus electricity, or do without it at times of demand elsewhere, which arbitrary ruling was borne with good grace, and the high load factor previously referred to was the result.

Scottish Centre.—The annual report of the Committee shows that during the 1928-29 session thirteen papers were read and discussed, and the syllabus included a greater number of informal papers, dealing with matters of local interest, than has been hitherto customary. The average attendance at the ordinary meetings was 73. The session closed with a total membership of 738, being an increase of 41 on the previous year. The Students' Section was specially active during the session, and two of the student members gained Institution premiums for their papers. The Dundee Sub-Centre held eight meetings, and the average attendance at ordinary meetings was 33; its membership at the close of the session was 51.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

We regret to state that Sir Hugo Hirst, Bart., has been seriously ill at his home at Earley, near Reading, but we are pleased to learn as we go to press that he is now well on the road to recovery.

Mr. G. R. T. Taylor has resigned his appointment as deputy-chairman of Vickers, Ltd., but retains his seat on the board. Mr. G. G. Sim, C.S.I., C.I.E., has been appointed deputy-chairman in his place. Mr. J. Reid Young, C.A., has been appointed secretary to the company in place of Mr. Sim.

Mr. Theodore Stevens's private address is now "The Patch," Dence Park, Herne Bay, Kent. (Telephone: Herne Bay 649.)

Mr. H. Simpson, formerly with the publicity department of Metro-Vick Supplies, Trafford Park, has joined the Wardle Engineering Co., Ltd., Old Trafford, Manchester, as publicity manager.

On November 9th, Mr. John Ritchie, late commercial manager of the Marconiphone Co., Ltd., left for Australia, where he is to manage the Australasian branch of the Gramophone Company (H.M.V.). At St. Pancras station, in the presence of a number of his late colleagues, Mr. Ritchie was presented with one of the newest "Marconiphone" portable receivers bearing an inscribed plate The presentation was made by Mr. C. W. Charlesworth, the general manager of the company.

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The Bristol Corporation Electricity Committee has appointed Mr. S. M. HILL, station superintendent of the Padiham station of the Lancashire Electric Power Co., as station superintendent at Portishead, at a salary of £672 per annum, and Mr. T. WELLS as boiler house superintendent at a salary of £511 per annum.

An interesting function was held at the Reform Club, Sheffield, when a number of business friends gave a complimentary dinner to Mr. A. E. JEPSON, who has left the General Electric Co., Ltd., Sheffield, to take up a position with the Manchester branch of the company. Councillor Melling was in the chair, and an inscribed gold wristlet watch was presented by Mr. H. Clarke, supported by Mr. T. Beardsell. This follows a presentation made by the Sheffield staff of the G.E.C. to Mr. Jepson of a handsome Sheffield plate candelabrum recently.

The Plymouth Corporation Tramways and Transport Committee has appointed Mr. CLEMENT JACKSON, general manager of the Oldham Corporation Tramway Department, as engineer and manager of the tramway and omnibus undertaking, at £850 per annum, rising to £1,000.

The Oldham Corporation Tramway Committee has appointed Mr. J. F. RICHARDS (rolling stock superintendent) as general manager of the Corporation tramway department at £650 per annum rising to £750.

On November 7th the Mayor of Hastings unveiled a tablet in honour of Mr. JOHN L. BAIRD on the building where, in 1923, he began three years' experiments in connection with television.

At a meeting of the Plymouth Corporation Electricity Committee, the engineer reported that Mr. F. HAYES had resigned his position as deputy engineer and station superintendent in consequence of continued ill-health. The resignation was accepted with much regret, and the Committee placed on record its appreciation of the services rendered by Mr. Hayes over a period of 27 years.

The salary of Mr. W. F. RUSSELL, city electrical engineer, Lichfield, has been increased from £250 to £275 per annum, rising to £300 next July.

Mr. R. L. ACLAND, M.I.E.E., is proceeding to India shortly on an extensive tour, during which he will visit all the principal electricity supply undertakings. He expects to be away about four months.

Mr. W. PRESTON, of Messrs. W. Sanders & Co., Wednesbury, formerly M.P. for Walsall, was the recipient last week from the Walsall Unionist Club of a settee and two easy chairs. Mrs. Preston was presented with a wrist watch.

Councillor C. P. DAVIS, C.C., the new Mayor of Deal, is the proprietor of the Maintenance Contracting Co. and the Electrical Appliance Co., of London, is a freeman of the City, and a liveryman of the Worshipful Company of Loriners.

Mr. E. H. M. ELDRIDGE, assistant sales manager to the Park Royal Engineering Co., has left that company to take charge of the Equipment Department of Powers Cinephone Equipment (Parent) Syndicate, Ltd., Film House, Wardour Street, London, W.1.

The Industrial Australian and Mining Standard states that Sir JOHN BUTTERS, chairman of the Federal Capital Commission, has accepted a seat on the board of directors of the British General Electric Co., Ltd.; also that Sir WILLIAM NOBLE, a director of the General Electric Co., Ltd., London, reached Fremantle for a visit to the Eastern Australian States early in October.

The Royal Society has awarded the Copley Medal to Prof. MAX PLANCK, Berlin University, originator of the quantum theory; the Davy Medal to Prof. G. N. LEWIS, California University; and the Hughes Medal to Prof HANS GEIGER, Kiel University.

The President and Council recommend the election of Sir ERNEST RUTHERFORD as President of the Royal Society for the ensuing year.

Obituary.—Mr. G. W. PEARD.—It is with deep regret that we learn of the death of Mr. George Wordsworth Peard, which took place on October 31st, in his sixty-second year. Mr. Peard will be chiefly remembered as a joint patentee in the Bates & Peard annealing furnace, a well-known method of annealing non-ferrous metals which revolutionised the annealing of copper. He was educated at Elstow School, Bedford, and on leaving school in 1883 he was apprenticed to his father's business of Hart Son & Peard, Drury Lane, London. When these works were pulled down to make room for the building of Kingsway and Aldwych, Mr. Peard joined the British Insulated Cables Co., in 1899, to start the new copper mills which this company was then erecting. He was superintendent of this department up to the time of his death, and saw it grow from small beginnings until it now gives probably the largest copper output in this country, and no doubt he contributed in no small measure to its success. Mr. Peard leaves a widow and three children.

MR. F. A. J. FITZGERALD. — The death occurred recently, at Niagara Falls, Ont., of Mr. Francis A. J. Fitzgerald, an electrical engineer of Continental reputation. Mr. Fitzgerald, who was 59 years of age, was a native of Dublin, and, going to the United States as a youth, entered the Massachusetts Institute of Technology, where he graduated in engineering. Mr. Fitzgerald began his career in the formation of the Carborundum Company, the success of which was largely due to his researches. In 1900 he was one of the founders of the Acheson Graphite Company in Niagara Falls. He subsequently engaged in practice as a consulting engineer, and in 1910 removed to Niagara Falls, Ont., where he continued to reside till the time of his death, holding retainers from many large engineering companies in Canada and the United States. Latterly he was engaged in researches looking to the discovery of a process for the commercial utilisation of low-grade iron ores. He was a member of the American Electro-Chemical Society, the American Institute of Electrical Engineers, and other technical organisations, and had received degrees from many universities in recognition of his scientific attainments.

MR. S. HARGREAVES. — Mr. Samuel Hargreaves, chief clerk of Blackburn Corporation Tramways Department, died on November 6th, aged 57. At the funeral six tramcar drivers and conductors acted as bearers. There were also present Alderman G. Burke (chairman of the Tramways Committee), Mr. J. H. Cowell (tramways manager), and Mr. H. W. Seymour (superintendent). Mr. Hargreaves, who was on the staff of the old company before the Corporation took control 30 years ago, had been chief clerk over 20 years.

SIGNOR GUIDO SEMENZA.—We learn with very deep regret of the death of Signor Guido Semenza, past-president of the International Electro-Technical Commission, which occurred

The late Signor G. Semenza, Past-President of the I.E.C.

on November 7th after a long illness. Signor Semenza was born in London in 1868 not far from Gloucester Road, and was educated in Milan. He spent some years in America with the old Edison Company, and was chief engineer of the Milan Edison Company until 1917, being afterwards appointed consulting engineer to the company. He was hon. secretary for the Congress on the Applications of Electricity in 1911; hon. secretary of the Italian Electrotechnical Committee; and one of the originators of the International Electro-technical Commission. He was a past-president of the Italian Institution of Electrical Engineers. He maintained close touch with industrial development, having reorganised an electricity meter works on mass production lines with American machinery. Signor Semenza did a great deal of experimental work in the Opera House in Milan, and many of the wonderful effects of modern theatre lighting are in large measure due to his researches. He was in New York in 1926 as president of the I.E.C., and he also presided in Bellagio in 1928, when the I.E.C. was magnificently received by the Italian nation and the Government. Some months ago the Institution of Electrical Engineers awarded him the Faraday Medal, the announcement being made at one of the meetings of last session. Outside of his scientific and industrial work Signor Semenza, like his great friend, Dr. John Lieb, who, it will be recalled, passed away quite recently in New York, was a great devotee at the shrine of Leonardo da Vinci. Whilst Dr. Lieb had probably the finest collection of manuscripts relating to the works of art of Leonardo da Vinci, Guido Semenza for years past had not been far behind. He was beloved by a very wide circle of friends and acquaintances, many of whom will feel his loss to be quite irreparable.

We have received the following letter from Colonel R. E. Crompton:—

"The death of Signor Guido Semenza, of Milan, one of Italy's leading electrical engineers, is indeed a great loss to that country, for undoubtedly the great development of electrical engineering which has taken place in Lombardy and in

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the northern provinces of Italy, and in parts of Switzerland, was largely due to Signor Semenza's initiative, and its success to his great engineering ability and skill. But the writer is chiefly concerned with his personality. Semenza, as president of the International Electro-technical Commission, although bowed down by a malady which he knew to be incurable, led our work with such zest and enthusiasm that he earned the respect and love of all the nationalities which are working for international standardisation in electrical matters. They will join me in testifying that the great success which that Commission has obtained is largely due to Semenza's unceasing efforts and charming personality. For all who have worked on international commissions know how much amity and progress depends on the personality of the leader.

R. E. Crompton."

Sir Henry Kirk.—The death occurred on November 9th of Sir Henry Kirk, K.C.I.E., at the age of 81. Sir Henry Kirk had experience of telegraph work in India extending over 42 years. According to *The Times*, he was educated at Edinburgh Academy and University, and joined the India Telegraph Department as an assistant superintendent in 1870. His excellent service gained for him a superintendency after only six years' service. For his work in providing telegraphic communication for the Northern Afghanistan Field Force in 1879 he was mentioned in dispatches and awarded the campaign medal and clasp, with the Viceroy's special acknowledgment of his services. After carrying out a number of special duties, he was appointed Director of Telegraphs in 1900. Two years later he was selected for the position of Director-in-Chief of Indo-European Telegraphs. His work in connection with the establishment of direct working between Calcutta and London was rewarded by his appointment to the Companionship of the Indian Empire. He was promoted to the knighthood of the Order upon his retirement from the India Office in 1912. Sir Henry was the senior delegate for India at the International Telegraph Conferences held in London in 1906 and 1912 and in Lisbon in 1908. The funeral took place at Barkham on Wednesday last.

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Heath Electrical & Gramophone Co., Ltd.—Private company. Registered November 8th. Capital, £1,500 in £1 shares. Objects: To acquire the business carried on by J. Cavendish at 9, South End Road, Hampstead, N.W.3, as the Heath Electrical Company, and to sell, purchase, let or hire, manufacture, fit, install, and maintain all kinds of wireless and other electrical apparatus, &c. The subscribers (each with one share) are: Miss F. M. Webb, 23, Victoria Road, Stroud Green, N.4; A. C. Crowe, 12, Holborn Viaduct, E.C.1, law clerk. J. Cavendish is the first director. (Secretary: A. C. Crowe). Registered office: 9, South End Road, Hampstead, N.W.3.

C. E. Greenwood, Ltd.—Private company. Registered November 9th. Capital, £2,000 in £1 shares. Objects:—To carry on the business of electrical engineers, manufacturers of, and dealers in wireless and electrical apparatus, &c. The subscribers (each with one share) are:—C. E. Greenwood, 26, Ellesmere Road, Dollis Hill, N.W.10, accountant; A. E. Bonner, 11, Ivy Gardens, Crouch End, N.8, solicitor's clerk. The first directors are to be appointed by the subscribers. Secretary (*pro tem.*): A. E. Bonner. Registered office: Walmer House, 296, Regent Street, W.1.

Elm Manufacturing Co., Ltd.—Private company. Registered November 9th. Capital, £1,000 in £1 shares. Objects:—To manufacture and deal in metal, ebonite, or composite parts, pressings, stampings, and resistances, condensers and parts, wireless, telegraph, and scientific instruments or component parts, gramophone motors, electrical gramophones, television and synchronising apparatus, &c. The directors are:—F. E. Franks, 29, Louisville Road, Tooting, S.W.17; D. W. Sayers, 14, Rectory Road, Beckenham, Kent, engineer. Qualification, 100 shares. Registered office: 131, Brixton Hill, S.W.2.

Official Returns of Electrical Companies.

Burgoyne Wireless, Ltd.—Debenture dated October 18th, 1929, to secure £1,000, charged on the company's undertaking and property, including uncalled capital. Holder: N. G. H. Dey, "Aberglaslyn," Amhurst Park, N.16.

Hooper's Telegraph and India Rubber Works, Ltd.—Capital, £50,000 in 1,000 preference and 4,000 ordinary shares of £10 each. Return dated July 29th, 1929. All shares taken up. £40,000 paid on the ordinary shares. £10,000 considered as paid on the preference shares. Mortgages and charges, nil.

Callender's Cable and Construction Co., Ltd.—Capital, £2,300,000 in 400,000 6½ per cent. cum. preference, 400,000 7½ per cent. "B" cum. preference, and 1,500,000 ordinary shares of £1 each. Return dated June 20th, 1929. 400,000 preference, 400,000 "B" preference, and 1,116,000 ordinary shares taken up. £1,255,000 paid. £661,000 considered as paid. Mortgages and charges, £300,000.

United River Plate Telephone Co., Ltd.—Capital, £8,000,000 in 40,000 preference, 1,216,000 ordinary, and 344,000 unissued shares of £5 each. Return dated July 2nd, 1929. 40,000 preference and 1,216,000 ordinary shares taken up. £6,200,000 paid on 40,000 preference and 1,200,000 ordinary shares. £80,000 considered as paid on 16,000 ordinary shares. Mortgages and charges, nil.

Victoria Electrical (Manchester), Ltd.—R. N. Brookes, of 6, Princess Street, Manchester, ceased to act as receiver or manager on November 2nd, 1929.

Ellesmere Port Electrical Co., Ltd.—Capital, £500 in £1 shares. Return dated June 19th, 1929. 400 shares taken up. £251 paid. £149 considered as paid. Mortgages and charges, nil. A return of allotments, made up to September 2nd, 1929, shows a further 50 shares alloted as fully paid.

Lisbon Electric Tramways, Ltd.—Capital, £1,500,000 in 1,000,000 ordinary and 500,000 preference shares of £1 each. Return dated July 10th, 1929. 944,288 ordinary and 425,553 preference shares taken up. £134,026 paid on 134,026 ordinary shares. £1,235,815 considered as paid on 810,262 ordinary and 425,553 preference shares. Mortgages and charges: £450,800.

Tisbury Electric Supply Co., Ltd.—Capital, £6,000 in £1 shares. Return dated May 23rd, 1929. All shares taken up. £6,000 paid. Mortgages and charges, nil.

H. W. Smith & Co. (1920), Ltd.—J. H. Stephens, of 6, Clement's Lane, E.C.4, ceased to act as receiver or manager on October 30th, 1929.

Guy V. Laycock, Ltd.—Capital, £10,000 in £1 shares. Return dated June 13th, 1929. 5,200 shares taken up. £1,200 paid. £4,000 considered as paid. Mortgages and charges, nil.

Austin Walters & Son, Ltd.—Capital, £3,000 in £1 shares. Return dated June 11th, 1929. 1,002 shares taken up. £2 paid. £1,000 considered as paid. Mortgages and charges, nil.

E. H. Maisner & Co., Ltd.—Capital, £1,000 in £1 shares. Return dated April 9th, 1929. 490 shares taken up. £490 paid. Mortgages and charges, nil.

Bowden & Higlett, Ltd.—Capital, £3,000 in £1 shares. Return dated July 31st, 1929. 2,025 shares taken up. £2,025 paid. Mortgages and charges, nil.

Ramsbury Electric Supply Co., Ltd.—Capital, £4,000 in 2,000 preference and 2,000 ordinary shares of £1 each. Return dated August 23rd, 1929. 1,532 preference and 1,988 ordinary shares taken up. £2,320 paid. £1,200 considered as paid. Mortgages and charges, nil.

Sykes & Dyson, Ltd.—Capital, £6,000 in £1 shares. Return dated June 8th, 1929. 5,000 shares taken up. £1,780 paid. £3,220 considered as paid. Mortgages and charges, £1,842.

Caxton Electric Developments, Ltd.—Capital, £300,000 in £10 shares. Return dated June 10th, 1929. 20,000 shares taken up. £70 paid. £199,930 considered as paid. Mortgages and charges, £200,000.

Ever-Ready Co. (Great Britain), Ltd.—Capital, £750,000 in 200,000 preference shares of £1 each and 2,200,000 ordinary shares of 5s. each. Return dated June 14th, 1929. 200,000 preference and 2,171,200 ordinary shares taken up. £279,855 5s. paid on 98,000 preference and 728,000 ordinary shares, leaving £144 15s. calls unpaid. £462,800 considered as paid on the remainder. Mortgages and charges, nil.

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Birmingham Mica Co., Ltd.—Issue on October 18th, 1929, of £750 debentures, part of a series already registered.

Truphonic Radio, Ltd.—Debenture dated October 30th, 1929, to secure £15,000, charged on land in London and the company's undertaking and property, present and future, including uncalled capital. Holders: Branch Nominees, Ltd.

R. W. Tarr, Ltd.—Debenture dated October 29th, 1929, to secure £2,500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: R. W. Tarr, "Hazeldene," Newton Road, Mumbles, Swansea.

Burndept Wireless (1928), Ltd.—Debenture charged on properties in Lewisham and Blackheath, and the company's undertaking and other assets, including uncalled capital, goodwill, and book debts, dated October 28th, 1929, to secure all moneys due or to become due from the company to Coutts and Co.

M. P. A. Wireless, Ltd.—Issue on October 11th of £500 and on October 24th, 1929, of £5,000 debentures, part of a series already registered.

Hardman & Co., Ltd.—Capital, £500 in £1 shares. Return dated June 6th, 1929. 480 shares taken up. £480 paid. Mortgages and charges, nil.

Budleigh Salterton Electric Light and Power Co., Ltd.—Capital, £6,000 in £1 shares. Return dated July 9th, 1929. 1,002 shares taken up. £1,002 paid. Mortgages and charges, £7,000.

Castle Fuse and Engineering Co., Ltd.—Capital, £15,000 in £1 shares. Return dated June 26th, 1929. All shares taken up. £12,998 paid. £2 in arrears. £2,000 considered as paid. Mortgages and charges at date of return, nil. Since registered: Mortgage dated July 4th, 1929, to secure company's banking account.

Automatic Coil Winder and Electrical Equipment Co., Ltd.—Capital, £10,000 in 8,000 ordinary and 2,000 deferred shares of £1 each. Return dated June 19th, 1929. All shares taken up. £3,000 paid. £7,000 considered as paid. Mortgages and charges, £1,800.

Eastern and South African Telegraph Co., Ltd.—Capital, £600,000 in £10 shares. Return dated September 11th, 1929. All shares taken up. £600,000 paid. Mortgages and charges, nil.

Siemens Brothers & Co., Ltd.—Capital, £3,000,000 in 550,000 10 per cent. cumulative preference and 2,450,000 ordinary shares of £1 each. Return dated June 10th, 1929. 550,000 preference and 2,000,000 ordinary shares taken up. £2,550,000 paid. Mortgages and charges, £724,300.

Chloride Electrical Storage Co., Ltd.—Capital, £750,000 in 62,000 preference, 395,550 "A" ordinary, 83,237 "B" ordinary, and 209,213 unissued shares of £1 each. Return dated June 1st, 1929. 62,000 preference, 395,550 "A" ordinary, and 83,237 "B" ordinary shares taken up. £155,411 paid on 48,750 preference, 92,913 "A" ordinary, and 13,748 "B" ordinary shares. £385,376 considered as paid on the remainder. Mortgages and charges, nil. A return of allotments, made up to June 21st, 1929, shows a further 28,418 "B" ordinary shares allotted as fully paid for the purchase of certain shares in Pritchett & Gold & E.P.S. Co., Ltd.

Dalgetti Electric, Ltd.—Capital, £500 in £1 shares. Return dated June 6th, 1929. 150 shares taken up. £150 considered as paid. Mortgages and charges, nil.

Premier Accumulator Co. (1921), Ltd.—Capital, £40,000 in £1 shares. Return dated June 26th, 1929. All shares taken up. £18,749 paid (being £1 per share on 11,249 and 15s. per share on 10,000 shares). £18,751 considered as paid on 18,751 shares. Mortgages and charges, nil.

Ringwood Electric Supply Co., Ltd.—Capital, £15,000 in £1 shares. Return dated June 28th, 1929. 11,356 shares taken up. £11,356 paid. Mortgages and charges, nil.

City Notes.

Aluminium Corporation, Ltd.

In their report for the year ended December 31st, 1928, the directors state that the trading profit amounted to £46,283 (against £54,669 in 1927). After meeting debenture, loan and mortgage interest there is a deficit of £61,780, which is added to the adverse balance of £130,043 brought forward, making a total deficit of £191,823 to be carried forward. The corporation's associate company in Norway has maintained regular supplies which have kept the Dolgarrog rolling mill running at full capacity, although prices remain somewhat low. Since the close of the year the hydro-electric portion of the corporation's undertaking has been sold to the North Wales Power Co., Ltd., under the terms of the agreement approved by the share and debenture holders. Following upon this sale, the directors, in view of the financial position, have had under consideration the necessity for some reorganisation of the capital and liabilities of the company, and in due course proposals to that end will be submitted to the shareholders. Meeting: November 18th.

Ruths Steam Storage, Ltd.

The first annual meeting of this company was held on November 4th, Mr. W. S. Eyre (chairman) presiding. In presenting the report and accounts, the chairman said they were only now commencing to show the results of business secured during the first few months of the company's life. They had, in fact, a substantial gross profit on contracts in hand. They had either installed or had under construction 58 Ruths steam storage systems, and there was every prospect that this rate of development would continue. The accumulators which had been manufactured by some of the leading iron and steel firms of this country had been equal in quality to those manufactured anywhere else in the world and at competitive prices. Referring to the future of the Ruths system in central power stations, the chairman said that the unique services which it rendered in the solution of peak-load problems would result in due course in large and profitable orders. The report and accounts were adopted.

Stock Exchange Notices.

Application has been made to the Committee to allow the following to be officially quoted:—

Cables & Wireless, Ltd.—£258,934 7½ per cent. non-cumulative "A" ordinary stock; £126,215 "B" ordinary stock; and £250,416 5½ per cent. cumulative preference stock.

Electrical Finance & Securities Co., Ltd.—150,000 ordinary shares of £1 each, fully paid, Nos. 1 to 150,000; 100,000 7 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 100,000, and £192,700 5½ per cent. debenture stock.

Shanghai Electric Construction Co., Ltd.—30,276 shares of £1 each, fully paid, Nos. 568,151 to 598,426.

Underground Electric Railways Co. of London, Ltd.—5,235 ordinary shares of £1 each, fully paid, Nos. 7,253,984 to 7,259,218.

Foundation Co., Ltd.

Presiding at the annual meeting on November 5th, Mr. G. B. Stone (chairman) said that of the principal contracts at home, one was with the Central Electricity Board for the North-west "grid" (a h.p. transmission line running from Crewe to Carlisle), and one with the London Power Co. for the construction of its new power station at Battersea. The value of uncompleted work at the end of June last was £1,650,000, this being the balance of contracts still in hand, totalling approximately £3,000,000. The report and accounts were adopted.

Birmingham and District Power and Traction Co.

At extraordinary meetings on November 25th the shareholders will be asked to approve a scheme whereby the issued 412,934 ordinary and 146,846 preference shares, together with the unissued shares of these classes will be consolidated into 700,000 ordinary shares of £1 each. It is also proposed to create 419,560 ordinary shares, raising the capital to £1,119,560, and to capitalise £559,780 and distribute it as a 100 per cent. bonus to the existing shareholders (preference and ordinary). A further proposal is that the name of the company shall be altered to "The Birmingham and District Investment Trust."

Belgian Company.

In their report for the financial year ending June 30th last, the directors of the *Société des Câbleries et Corderies du Hainaut*, Dour, state that the great extension of the electricity distribution system in Belgium has resulted in many important contracts for electric cables. The export trade has also shown considerable extension, sales having been made in several new markets. The development of the underground telephone system in Belgium has also added to the company's activities.

Buenos Ayres Lacroze Tramways Co.

The gross receipts for the year ended June 30th last were $7,890,071 (against $7,973,708). After meeting working expenses, debenture interest, &c., there is a net balance of $1,402,816. The reserve fund receives $68,347, the board's fees amount to $68,347, the shareholders receive $1,000,000, and $200,000 is placed to extraordinary reserve fund, leaving $66,120 to be carried forward.

Midland Counties Electric Supply Co.

The directors announce their intention of issuing the balance of the authorised share capital (£250,000) in the form of £1 ordinary shares. These are being offered to the present shareholders in the proportion of one new share for each eight held, at the price of 26s. The proceeds will be devoted to the repayment of bank loans and in meeting further capital expenditure.

Metropolitan Electric Supply Co., Ltd.

A proposal to raise the company's capital to £2,500,000 by the creation of 500,000 shares of £1 each was approved by the shareholders on November 6th. Mr. G. Balfour (chairman), who presided at the meeting, said that it was intended to offer the new shares to the present shareholders at 30s. each in the proportion of one new share for each three held.

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Bristol Tramway and Carriage Co., Ltd.

An extraordinary meeting is to be held on November 26th to consider resolutions providing for the sub-division of the £10 preference and ordinary shares into shares of £1 denomination; and for the alteration of the company's articles of association to comply with Stock Exchange requirements.

John I. Thornycroft, Ltd.

The net profit for the year ended July 31st last was £129,700, against £113,012 in 1927-28. The directors recommend a final dividend of 5½ per cent. on the participating preferred ordinary shares (again making 9 per cent. for the year), and a dividend of 17½ per cent. (against 15 per cent.) last year on the ordinary shares.

Amazon Telegraph Co., Ltd.

The gross revenue for the year ended June 30th last was £52,663, and after meeting debenture interest, &c., and bringing in the balance of £940 from the last account, there is a debit balance of £5,030 to be carried forward. Meeting: November 19th.

Ferranti, Ltd.

The profit for the year ended June 30th last was £66,976, against £56,798 in 1927-28. The directors recommend an ordinary dvidend of 12 per cent., free of tax. Last year's dividend was 20 per cent. but during the year the capital was increased by £40,000 in bonus shares.

British Electric Traction Co., Ltd.

The directors announce the payment of the interim dividends on the 6 per cent. cumulative participating preference stock (3 per cent.) and 8 per cent. non-cumulative preferred ordinary stock (4 per cent.).

Cawnpore Electric Supply Corporation, Ltd.

An interim dividend of 3 per cent. has been declared on the ordinary shares, as last year.

Johnson & Phillips, Ltd.

The directors have declared an interim dividend of 5 per cent. actual (as last year) on the ordinary shares.

Siemens Bros. & Co., Ltd.

The interim ordinary dividend is again 2½ per cent.

Dutch Company.

Philips Glow Lamp Works.—The general meeting of shareholders, on November 4th, unanimously adopted a proposal to increase the capital from 100,000,000 to 200,000,000 florins, divided into 62,500 cumulative preference shares and 187,000 ordinary shares. Replying to questions regarding future prospects, Dr. Philips announced that he anticipated a greatly increased output, particularly of wireless sets, and ascribed the recent dismissals to rationalisation and the introduction of new machinery.—*Reuter* (Amsterdam.)

It was stated in reply to questions that the increased capital was needed for the financing of stocks in all countries, the extension of the works, and the covering of debts. It was further mentioned that the sale of glow lamps was increasing in a normal manner, while that of radio apparatus was largely augmenting, and a further expansion was expected provided that the Bourse crisis did not restrict the turnover. It was considered probable that the greater profits this year would permit of the writing off of the value of the new works.

Swiss Companies.

The *Oerlikon Machinery Co.* reports a further increase in the orders booked in 1928-29, noteworthy contracts having been placed by other countries, particularly Spain and Belgium. The net profit amounted to 1.98 million fr., as compared with 1.96 millions in 1927-28, and the dividend remains at 8 per cent.

The *Swiss Locomotive and Machinery Works*, Winterthur, states in its report for 1928-29 that although locomotive export orders were completed, practically no new foreign contracts were received; and also the orders from the Swiss Federal Railways were fewer, only some electric shunting locomotives having been delivered. On the other hand, the engine and compressor branch was more successful. The accounts show a decline in the net profits from 1.17 million fr. in 1927-28 to 0.81 million last year, and the dividend falls from 7 to 6 per cent.

Norwegian Company.

It is announced that the *Norsk Hydro Company* is to increase its share capital from Kr.76,852,800 to Kr.104,999,940 by an issue of ordinary shares. The purpose of the new issue is to finance an extension whereby production will be increased to 90,000 tons of nitrogen fertiliser a year. A large part of the new issue will be subscribed for by the German Dye Trust, which is already closely associated with the Norwegian company. The company's net profit for 1928-29 amounts to Kr.4,047,251, against Kr.1,313,730 in the previous year.—*Financial Times.*

French Companies.

The *Société La Manufacture Moderne de Fils Electriques et Isolants* has declared a dividend of 6 per cent. on the ordinary shares for 1928-29.

The *Société des Câbles et Matériel Electriques G. Bouchery* reports a net profit of 1,437,000 fr. for 1928-29, which has been placed to the reserve fund.

The *Société Electro-Câble* records an increase in the net profit from 8,740,000 fr. in 1927-28 to 11,670,000 fr. last year. It is proposed to maintain the dividend at 10 per cent., although the capital participating for 1928-29 is 82,500,000 fr. as against 50,000,000 fr. in the previous year.

Stocks and Shares.

TUESDAY EVENING.

THE effect of the panic in the United States, which brought down with such a run the prices of stocks and shares in American utility companies, has worn itself out, so far as the immediate fever is concerned. There have been a few rallies from the lowest prices touched, though these recoveries were feeble and hesitating, nor have they resulted in any material advance in prices. The New York Stock Exchange is closing throughout the current week at one o'clock, instead of remaining open until four, the intention being to enable Wall Street brokers to catch up with the arrears of work; also that they may gain a clearer estimate of how they stand than a good many of them seem to be able to get at present. The reaction of the panic holds down prices to some extent over here, where the issue of the new five per cent. Conversion Loan brought about a general weakening of values amongst gilt-edged securities. There is some talk of a possible fall in the Bank Rate.

New Electrical Issues.

The Metropolitan Electric Supply Company has now issued its allotment letters of one new share, at 30s., in respect of every three shares previously held. The effect was to cause a net drop of about 5s. in the Metropolitans, reducing the price to 38s. 9d. ex rights. The new shares are 7s. premium. The Midland Counties Electric Company has also issued new shares, one new at 26s. being allotted in respect of every eight old shares held. As the price of the latter was standing at about 30s. before the new issue's announcement, the bonus is nothing very much. The old fell back to 28s. ex rights, and the new are 7½d. premium. The tendency of electric lighting shares is towards lower levels. This is due, of course, directly to the influence of the American disturbance, for the Americans are known to have accumulated a good many shares in various British companies, and part, at all events, of these have probably been sold. It is the same in America as it is on this side when anything approaching demoralisation is afoot; namely, that people sell what they are able to sell, being left with too much other stock, as a rule, for which they are unable to come across any buyer.

Electricity Supply Heaviness.

County of London shares have gone back to 50s. 6d., showing a fall of 1s., and some of the other London shares are a shade easier. Most of the provincial supply issues have receded: Bournemouth & Poole, for instance, and Newcastle ordinary—although the last-named company's 5 per cent. preference are better at 19s. 3d. Electrical Distribution of Yorkshire shares drooped to 34s. 9d., Isle of Thanet ordinary to 34s. 6d., Northamptons to 47s. Some of the Indian shares are also heavy; Calcutta Supply being lower at 54s. ex dividend. Atlas, at 26s. 6d., are ex dividend, the preference remaining at 24s. 3d. British Power & Light are 6d. better, at 14s. 6d. Scottish Power new shares eased off to 28s.

Dollar Stocks.

A violent fall in Hydro-Electrics reduced the price to 32, which is less than half the price which obtained a month ago. This followed the announcement that the company had doubled its previous quarterly dividend of 25 cents. The fall in price leaves the shares 15½ points down on the week. Montreal Light, Heat & Power, at 120, is 30 points to the bad. Pennsylvanias, at 80½, are 9½ down. Power Corporation of Canada, at 82½, have shed 8 points. Mexican Light & Power Company shares have parted from the 5 dollars that they gained last week, and another 5 as well; Canadian General Electrics remain unchanged at 410; Calgary Power shares, at 165, show a fall of 10; Shawinigans are down to 79. American Telephone & Telegraph, at 210, compare with 245. International Telephone & Telegraph were 90 a week ago, and are now 75. Brazilian Tractions have dropped to 39, which is a fall of 9½, and the six per cent. preference shares are lower at 140, this being the middle quotation in the Stock Exchange official list to-night (Tuesday), and looking odd against the price at which the last bargain was done, namely, 217, a fortnight earlier. These falls, ranging from 5 to 35, follow upon others, even steeper, and have occurred in less than a week.

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Home Rails.

Underground Electric stocks have fallen in price because of the fear of labour trouble induced by the strike of 'busmen in the early part of the week. The difficulty seems to have arisen over matters outside the scope of the company's own domain, and to have been a domestic matter between two unions, but the result was a strike which, from the Stock Exchange point of view, was likely to prove unfavourable, and Underground incomes consequently fell 3 points to 102. The shares dropped to a guinea, showing a loss of 1s. 6d. It may be that, in addition to the ostensible cause of the strike, the weakness in prices was emphasised by the effect of the American collapse, and the necessity which this imposed for raising money by the sale of anything which was realisable on the part of Americans compelled to have cash at all costs. It is, of course, a well-known fact that a great many of the Underground Electric Railway's income bonds were held by Americans, and it is quite likely that some of these bonds have been finding their way back to the London market. Metropolitan consolidated eased off to 60 in sympathy.

Tramway and Traction.

Amongst the tramway and transport stocks no particular change occurred, so far as the London issues were concerned. British Electric Traction deferred ordinary, at 1,325, is £150 down, making a fall of £275 within a fortnight. The drop would be more noteworthy, it is true, were it not for the fact that the stock had risen even more rapidly than it has given way, in the earlier part of the current six months. Mexican issues are, generally speaking, heavy, Mexico Tramway 5 per cent. bonds going back 7½ points to 65. There has been a good deal of uneasiness in connection with stocks and shares in countries associated with Brazil, owing to the apprehensions that have arisen around the financial position of the country. Within the past few days, however, a better tendency set in, on the impression that Brazil may be able to raise a new loan in Paris. One consequence has been a recovery in the prices of Rio bonds, the Tramway, Light & Power Company's 5 per cent. first mortgage bonds rallying to 95½, though the 50-year mortgage bonds, at 86, are, if anything, slightly lower on the week.

The Manufacturing Group.

The group of manufacturing companies' shares is dull, the principal loss being one of 7s. 6d. in Henley's, at 5⅞. Here, again, the reason for the fall must be ascribed to the necessity of raising money through the medium of anything which is saleable, rather than the fall being due to anything connected with the company itself. General Electrics dropped 5s. to 43s. 9d., and Associated Electrical Industries ordinary shares, at 32s. 6d., are 1/16 down. Johnson & Phillips went back to 38s. 9d., British Aluminium ordinary to 46s. 3d. Many people are asking whether it may not be judicious to sell ordinary shares of industrial undertakings, particularly those upon which the yield, on the basis of present-paid dividends, is small, and to re-invest the money in gilt-edged securities now that the Government has reduced the national credit to 5 per cent. The feeling of uncertainty which continues to prevail in regard to the outlook for the financial position in New York, Paris, Brussels, Amsterdam, and other centres abroad, is an added reason for the disinclination of the public to take a hand in the purchase of industrials upon which the return is not particularly tempting in the light of the 5 per cent. yield derivable from British Government securities. This tendency is likely to become more pronounced the nearer the year draws to Christmas, and to the window-dressing that invariably follows it.

Miscellaneous Matters.

Babcock & Wilcox receded to £3, showing a loss of 1/16; Vickers are a little lower, at 7s. 10½d. The disposition of iron, coal and steel shares is heavy as a whole. Rubber shares are in no better plight; in fact, the fall to a little under 8d. per lb. in the price of the commodity has deepened the depression which previously overhung the rubber share market. A good many of the established estates are working at a cost of about 6d. per lb., but between this and present price of rubber the margin looks slender as compared with what it was, say, a year ago, at the time when the removal of restriction had run only a fortnight.

That Blessed Word Rationalisation.

At the Old Cromptonians' dinner, held last week at the Savoy, Colonel Crompton took the chair, and, in spite of his advanced years, he made an excellent president of the function. The principal speech of the evening was that of Major Colin Cooper, who urged strongly and fluently the claims of rationalisation as being applicable to the electrical manufacturing industry. His speech was followed with the closest attention, and it elicited a good deal of support, as Major Cooper made his points in furtherance of the theory that expenses can be cut down on the one hand, and profits increased considerably on the other, by the introduction of up-to-date methods, and by the elimination of waste. There may have been some at the dinner who read into the speech a hint that closer alliance may be projected between certain of the companies in the industry; but nothing was said which did more than very vaguely hint at future possibilities.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom.	Approx. Dividend. 1927.	1928.	Price Nov. 12 1929.	Rise or fall	Yield p.c.
	£					
Bournemouth and Poole	1	15	15	60/-	—2/-	5 0 0
Brompton Ordinary	1	8½	8½	26/-	—	6 7 8
Charing Cross Ordinary	1	8½	8½	26/6	—	6 5 8
do. do. 4½% Pref. ...	1	4½	4½	17/-	—	5 6 0
Chelsea	1	8¾	8¾	25/-	—	6 13 0
City of London	1	10	10	32/-	—	4 7 6
do. do. 6% Pref.... ...	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	1⅞	—1/8	... ...
County of London	1	7	10	50/6	—1/-	3 19 6
do. do. 6% Pref.... ...	1	6	6	22/6	—	5 6 8
Edmundson's 7% Pref.	1	7	7	24/-	—	5 16 8
Elec. Supply Corporation	1	11	11	52/-	—	4 4 8
Kensington Ordinary	1	8	8	26/-	—	5 7 8
Lancs. Light and Power	1	7½	7½	28/-	—	5 7 2
London Electric	1	8½	9	27/6	—	5 1 10
Metropolitan	1	9	9	38/9xr	—¼	4 12 9
do. 4½% Pref.	1	4½	4½	17/-	—	5 6 0
Midland Counties	1	6½	6½	28/-xr	—1/9	4 12 10
Mid. Elec. Power	1	15	8	34/6	—	4 12 9
Newcastle-on-Tyne Ordinary ...	1	6	6	24/6	—1/9	4 18 0
do. 7% Pref.	1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	10	6	6	11	—	5 9 1
North Met. Elec. 6% Pref.	1	6	6	21/6	—	5 11 8
St. James' and Pall Mall	1	8	8	26/6	—	5 5 8
Scottish Power	1	8	8	30/-	—	5 6 8
South London	1	8½	8½	26/6	—	5 5 8
Urban Ordinary	1	7	7	37/-	—	3 15 8
Westminster Ordinary	1	8½	8½	25/6	—	5 9 10
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	23/6	—	6 7 8
Yorkshire Elec.	1	8	8	33/6	—6d.	4 15 7

HOME RAILS.

Central London Ord. Assented ...	Stock	4	4	71	—	5 12 8
Metropolitan	‘	8	8½	60	—	5 16 8
do. District	,,	4	5	73	—	6 17 0
Underground Electric	£1	5	7	21/-	—1/6	6 4 3
do. do. Income ...	Bonds	6	6	102	—8	5 17 8

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	98½	—	5 1 10
do. Def.	,,	1½	1½	24½	—	6 4 5
Automatic Telephone	1	10	12½	87/6	—	6 13 4
Cables & Wireless 5½ Pref.	Stock	—	—	97½	—	5 12 10
do. A 7½ Ord.	,,	—	—	81½	—1	... ...
do. B Ord.	,,	—	—	47½	—8	... ...
Globe Tel. and T. Ord. ...	10	10	10	23½	—	*4 6 1
do. do. Pref.	10	6	6	10⅝	—	5 9 1
Great Northern Tel.	10	20	17½	29	—	6 0 9
Indo-European	25	10	10	47½	—	*5 5 8
Marconi-Marine	1	12½	15	2⅜	—⅛	... ...
Oriental Telephone Ord	1	12	12	2⅛	—	... ...

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	8⅛	—	8 19 6
do. do. 2nd Pref. ...	5	6	6	8⅛	—	9 16 0
do. do. 5% Deb. ...	Stock	5	5	75	—	6 13 4
British Electric Traction Def. Ord.	,,	5	5	1825	—150	... ...
do. do. Pref. Ord.	,,	8	8	124½	—	6 8 6
Brazil Traction	100	7	8	89	—9½	5 2 6
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	86½	—	5 15 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	9/6	—	... ...
London United Tram Deb. ...	Stock	4	4	51½	—	7 15 4
Mexico Trams, 5% Bonds	—	5	5	65	—7½	7 12 8
Mexican Light Common	100	Nil	Nil	80	—10	... ...
do. 7% Pref.	100	7	7	77½	—	9 0 8
do. 1st Bonds	—	5	5	77½	—	6 9 0
Yorkshire (West Riding)		Nil	Nil	5/-	—	... ...

MANUFACTURING COMPANIES.

Assoc. Elec. Ord.	1	6	—	32/6	—½	3 13 10
Babcock & Wilcox	1	18	15	3	—1/16	*5 0 0
British Aluminium Ord.	1	10	10	46/3	—1/16	*4 6 5
British Elec. Transformer Pref. ...	1	7	7	18/-	—	... ...
British Insulated Ord.	1	15	15	8½	—	3 17 4
Brush Ord.	Stock	10	10	126½	—	7 18 1
Callenders	1	15	15	3⅜	—⅛	4 2 8
do. 6½% Pref.	1	6½	6½	1¼	—	5 4 0
Crompton Parkinson Ord.	5/-	—	80	20/6	—	7 6 6
do. 8% Pref.	1	8	8	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	7 1 2
do. 5% Deb.	Stock	5	5	84½	—	5 18 4
Electric Construction	1	7½	6½	15/-	—	7 6 8
Enfield Cable Ord.	1	20	20	4½	—	4 2 0
English Electric	1	Nil	Nil	7/6	—	... ...
do. do. Pref.	1	8	Nil	8/9	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
do. Ord.	1	10	10	2⅜	+⅛	4 11 4
Henley...	1	25	20	5⅝	—⅜	4 2 0
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	Nil	Nil	11/8	—	... ...
Johnson & Phillips	1	10	—	38/9	—1/8	5 8 0
Siemens Ord.	1	7½	7½	27/6	—	5 9 1
Telegraph Construction	12	10	12	23	—	5 4 2

*‡Dividends paid free of Income Tax.

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Far Eastern Electrical Trade.

A Review of a Report upon Japan and Statistics of China's Imports.

Japanese Trade and Industry.

THE Department of Overseas Trade has published a report upon economic and financial conditions in Japan by Mr. G. B. Sansom, C.M.G., and Mr. R. Boulter, C.M.G., respectively Commercial Counsellor and Commercial Secretary at the Tokio Embassy.*

As is customary the report is prefaced with a commercial summary giving salient facts regarding the country's population, area, trade, &c. The Japanese sphere of influence covers an area of 695,929 sq. km., embracing a population of 84,567,000. The imports in 1928 were valued at 2,196,314,727 yen (yen=1s. 10½d.), of which 164,840,000 yen was attributed to the United Kingdom, 285,470,740 yen to British India, 130,494,754 yen to Australia and 625,503,082 yen to the United States. Japan's exports during 1928 had a total value of 1,971,955,352 yen, the United Kingdom accounting for 58,904,459 yen. English is generally used for foreign commercial correspondence.

The General Situation.

The authors say that the period under review (the year ended June 30th last) may be loosely described as a period of recovery retarded by restrictions on credit due to the lack of confidence and the disruption following the financial crisis. In spite of financial upheavals and disastrous individual failures, however, in the major industries of the country there has been in the aggregate a steady and considerable increase in the volume and quality of production. In the opinion of the writers, making allowance for all unsatisfactory features, industrial progress has been remarkable and well sustained. Foreign trade has been maintained at about the same level for the past three years. An important feature of Japan's foreign trade to-day is the fact that more than half of the imports consist of raw materials. These are essential to Japanese industries and consequently in any financial disturbances, it is the import trade in manufactured goods which suffers.

Electrical Import Trade.

There was a substantial increase in the machinery import trade during 1928, the total value being 92,205,000 yen, against 78,612,000 yen in 1927. Among the items which participated in this increase were dynamos, motors and transformers, the imports of which rose in value from 7,030,000 yen to 7,432,000 yen; and water turbines and Pelton wheels whose value rose from 517,000 yen to 559,000 yen. On the other hand, the value of imported "dynamos combined with motive machinery" fell from 1,187,000 yen in 1927 to 349,000 yen last year. There has been a remarkable rise in the imports of internal-combustion engines, partly for use where electricity is not yet available and partly for power stations and as stand-by plant.

The United States leads in the supply of machinery to Japan, and this is particularly true of electrical machinery. During 1928 the imports of dynamos, motors and transformers came from the following sources; the 1927 value is given in parentheses:—United States, 4,274,000 yen (3,956,000 yen); Germany, 1,599,000 yen (1,090,000 yen); Great Britain, 1,011,000 yen (1,282,000 yen); and Switzerland, 388,000 yen (520,000 yen). The competition for business in machinery is very keen, especially for the supply of large electrical plant. The development of the use of electricity in Japan assures a steady demand for machinery of this type. The Japanese manufacturers are reported to have experienced difficulty of late in obtaining sufficient orders to keep their works occupied. The progress made by industry in general affords openings for specialised types of machinery. The demand is often too limited to justify manufacture in Japan. It is in this direction that the British manufacturer might be advised to concentrate his efforts. The services of a trained representative with works experience are very necessary; such a representative should be able to study the requirements of a particular industry and demonstrate the advantages of new appliances far more efficaciously than the staff of an importing house. It must be recognised, however, that while business remains in the present state of depression, orders are hard to secure, and some time may elapse before the efforts of a special representative of the type indicated can produce results.

Railway Electrification.

At the end of 1928 the Government-owned railways had a total length of 8,485 miles, of which 126 miles was electric. The non-Government railways in operation represented 3,642 miles, 1,708 miles of which had been electrified, and a further 1,092 miles (538 miles electric) was under construction. In addition to the above, the construction of 2,562 miles of railway by private companies has been sanctioned, of which 1,654 miles will be electrified. There is at present only one underground electric railway in Japan, that in Tokio, with a length of about 1½ miles. This is being extended and projects are under discussion for other lines in Tokio, as well as in Osaka, Kobe and Nagoya.

Radio-telegraphy and Broadcasting.

Radio communication between Japan and foreign countries is in the hands of the Japan Wireless Telegraph Co., Ltd. Various extensions of the existing equipment are planned. At the end of June a one-way short wave traffic service, England to Japan, was to be opened. For the American services new stations are to be commenced in 1930, and opened for service in 1932. During the current year the erection of transmitters and receivers for direct communication with the Philippines, French Indo-China, the Dutch East Indies, British India, Australia, the South Sea Islands, China and Siberia were to be commenced, and will be put into operation in 1931. All transmitters for these stations will use short waves, and the instruments will be capable of handling over 100 words per minute.

During the past twelve months there has been considerable development in broadcasting generally throughout Japan. The seven new 10-kW stations anticipated in last year's report were established during the autumn of 1928, and were functioning satisfactorily in time for the Coronation in November. The trade with Great Britain is now comparatively small owing apparently to America being nearer and prompter in getting its novelties on to the market. British manufacturers are urged to submit anything they have to offer likely to suit present needs with as little delay as possible, and arrangements should be made for business to be done by cable rather than mail. The necessity is again impressed on such makers for the careful supervision of shipments, and absolute uniformity in the quality and efficiency of bulk deliveries.

Formosa and Corea.

There are two annexes to the report dealing with conditions in, and the trade of, Formosa and Corea. The first makes reference to the Lake Candidius hydro-electric scheme. This project was abandoned some years ago, but it has now been revived, and work will be recommenced at an early date. It provides for the development of 100,000 kW at Lake Candidius in the centre of the island by the semi-official Formosan Electric Power Co. The completion of the scheme is regarded as essential in order to stimulate industrial development, and arrangements have now been made to obtain the necessary funds. The Formosan Government is to invest a further 4,500,000 yen in the company, and the balance of 49,000,000 yen will be raised by a loan in Japan or abroad. According to present plans the enterprise should be completed about the end of 1922 The machinery already purchased (10,000,000 yen worth) is reported to be in good condition, and future expenditure will be mainly for labour in the construction of tunnels, dams, &c. No decision has yet been reached regarding the utilisation of the power when it becomes available. One suggestion is the manufacture of fertilisers, with the object of supplanting to some extent the present large imports of sulphate of ammonia.

The new radio-telegraph stations at Itabashi (transmitting) and Tamsui (receiving) in the north of the island were completed at the end of 1928, and stations in the Pescadores and at Tainan have recently been opened. A 1-kW broadcasting station was opened in Taihoku at the end of 1928, and in view of its success provision has been made in the current budget for another station (10 kW), which will be ready by the spring of 1930.

A project for the production of sulphate of ammonia is also referred to in the report upon Korea (by Mr. O. White, British Consul-General at Seoul). This is a factory near Kanko, which will use power from its own hydro-electric plant, which is eventually to develop 160,000 kW. Water from the basin of the Yalu River is led by a tunnel from the western side of the watershed, where the slope is gradual, through the mountain to the eastern side, where advantage is taken of the steep incline. The generator station is said to be as large as any found in Europe, and is equipped, apart from certain apparatus of a special nature, with machinery built in Japan. It was this scheme which was partly responsible for a large rise in the machinery imports during 1928 (from 9,420,000 yen to 16,005,000 yen). In 1928 the value of the imports of electric dynamos was 101,000 yen, divided between Germany (47,000 yen), the United States (28,000 yen), and Great Britain (26,000 yen).

* Stationery Office, 3s. net.

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Import Trade of China.

TURNING now to China, the following table shows the imports into that country last year of electrical and allied material and machinery. The corresponding figures for 1927 are given and notes of increases or decreases added. As throughout recent years, it is again noteworthy that in spite of disturbance by war and banditry the trade in electrical plant and material continues to grow. It is particularly satisfactory to find also that Great Britain's share in this trade, save for one or two unimportant items, is either well maintained or shows an increase. Japan's sales of electrical material and fittings and of telegraph and telephone material have been very steady, and those of the United States in all lines are advancing. It is probable that a great deal of the trade credited to Hong-Kong was transacted with the United Kingdom. The Haikwan tael fell in average value from 3s. 1½d. in 1926 to 2s. 9 13/16d. in 1927 and rose slightly to 2s. 11 1/16d. in 1928.

Country whence imported.	1927. Taels. (thous.)	1928. Taels. (thous.)	Inc. or dec. Taels. (thous.)
Brass and yellow metal; bars, sheets, wire, &c.—			
Total	1,654	2,036	+ 382
Hong-Kong	383	397	+ 14
Great Britain	44	56	+ 12
Japan	1,072	1,360	+ 288
Belgium	4	8	+ 4
United States	2	15	+ 13
Germany	142	183	+ 41
France	—	7	+ 7
Copper bars, rods, sheets, plates, nails, and wire.—			
Total	1,036	1,115	+ 79
Hong-Kong	62	95	+ 33
Great Britain	59	39	− 20
Japan	772	754	− 18
Germany	104	103	− 1
Belgium	8	35	+ 27
United States	20	63	+ 43
Electrical materials and fittings.—			
Total	9,868	11,307	+1,439
Hong-Kong	778	743	− 35
Great Britain	1,589	2,043	+ 454
Italy	111	79	− 32
Japan	4,090	4,177	+ 87
Canada	63	15	− 48
United States	1,561	1,895	+ 334
Sweden	13	9	− 4
Belgium	213	299	+ 86
Holland	123	242	+ 119
France	243	166	− 77
Germany	966	1,321	+ 355
Propelling machinery, such as boilers, turbines, &c.—			
Total	2,980	2,566	− 414
Great Britain	1,227	1,192	− 35
Japan	292	195	− 97
United States	539	534	− 5
Sweden	41	42	+ 1
Germany	188	233	+ 45
Belgium	503	13	− 490
Italy	30	68	+ 38
Telegraph and telephone material, including wireless apparatus.—			
Total	2,066	1,848	− 218
Hong-Kong	243	141	− 102
Great Britain	443	189	− 254
Japan	237	291	+ 54
Canada	10	3	− 7
United States	212	230	+ 18
Sweden	97	87	− 10
Germany	242	234	− 8
Belgium	350	279	− 71
France	73	43	− 30
Italy	5	19	+ 14
Scientific instruments and apparatus.—			
Total	1,244	1,783	+ 539
Great Britain	102	142	+ 40
Germany	314	519	+ 205
Belgium	—	2	+ 2
France	27	37	+ 10
Japan	492	438	− 54
United States	197	399	+ 202
Machinery for electric power stations.—			
Total	1,292	1,316	+ 24
From Great Britain	605	410	− 195
,, Germany	94	70	− 24
,, Japan	23	137	+ 114
,, United States	259	449	+ 190
,, Hong-Kong	59	49	− 10
,, Italy	202	61	− 141

Salesmanship in Argentina.

An Example and a Suggestion.

SOME rather startling salesmanship methods are revealed in a report by Mr. J. G. Burke, the assistant commercial attaché to the United States at Buenos Aires, on the Argentine market for vacuum cleaners. They are of special interest in view of the discussion on marketing procedure in that part of the world which has been aroused by the visit of the British Economic Mission to South America. After some general remarks on the opening for the sale of this class of apparatus in Argentina, Mr. Burke deals in particular with a well-known type of Swedish vacuum cleaner. He says that modern sales methods are employed, the sales representatives being divided into groups of eight to ten, each group under the supervision of a sales chief who is paid not only a regular salary but also a commission of from 6 to 8 per cent. on each machine sold by the men in his group. The individual receives no salary, being entirely dependent on the sales commission amounting to nearly £4 per machine which he sells. The average period for which a salesman is employed is said to be only three weeks, as after he has exhausted the possibilities of selling to his close friends and relatives he has to seek other employment. The losses incurred are reported to be considerable. Owing to the deficiency of the Argentine commercial code covering material on consignment, there is practically no way by which the seller can recover the apparatus once it is left in the hands of a prospective client to be paid for on the instalment plan. Many cases are on record where salesmen have disappeared with three or four machines because they were no longer able to earn commissions. It is said that these losses reach from 5 to 7 per cent. of the total value of the sales during the year; the experience of the company, however, allows it to discount this factor in determining the final sales price. This can be seen from the fact that the landed cost of the vacuum cleaner is about £6 10s., whereas the retail price, including interest, is £22.

These revelations of high-pressure salesmanship are surprising, but despite the losses and heavy overhead charges, the American Commercial Attaché says that they are evidently successful. Not only is the Swedish concern increasing the number of its branch stores in Buenos Aires, but it is also opening up new sales rooms in the larger provincial cities and increasing the sales force under each of these. A great factor in effecting the growing turnover is the instalment purchase system, which appeals to the buyer even though the retail price of an American cleaner is at least one-third less than that of the Swedish article.

What could a British firm do against such methods as these? The question is one that seems to merit examination, for it is estimated that there are 3 million people in the Republic who may be considered purchasers of such articles such as electrical household appliances and labour-saving devices. It should surely be possible for a British firm to place on the market a cleaner at a price which need not show such a great discrepancy between the landed cost and the ultimate price to the customer, thus giving the latter the benefit, and making it unnecessary to employ what appear to be risky selling methods. Mr. Burke himself suggests that with proper advertising, to the expense of which the manufacturer must contribute, a conservative sales programme will appeal to the buyer who will not be troubled with the rather inferior class of salesman who is responsible for the successes obtained by the European manufacturer at present dominating the market. It may also be suggested that, in consultation with firms in the Republic which are versed in local credit information and deferred payment methods, an equally appealing but less costly and hazardous sales campaign might be devised.

The British Industries Fair.

A step towards improving the appearance of stands in the London section of the British Industries Fair was taken by the exhibitors' advisory committee on November 4th, when it was agreed that, except by special permission, all stands at Olympia made of stock material should have fascias 3 ft. deep on pilasters 8 ft. high. It was stated that there was no intention of interfering with stands owned by exhibitors, or those of a distinctive type or design, but that much could be done towards uniformity by avoiding the unnecessary irregularities of ordinary stands. Some idea of the convenience of the London section's new premises from the buyer's point of view may be gathered from the fact that the distance which a buyer at Olympia will have to walk to the least accessible stand from the nearest entrance will be only 130 yards, as compared with half-a-mile at the White City. The distance between the two sections which are farthest apart will be 100 yards, as compared with a mile at the White City. There will be four main entrances—one in Addison Road, two in Hammersmith Road, and one in Blythe Road. The whole of the Fair will be on two floors.

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A New London Tramcar.

A "Pay-as-you-Pass" Experiment by the Metropolitan Electric Tramways, Ltd.

IN addition to improving the old types of rolling stock in respect of both equipment and passenger accommodation, the tramway companies of the Underground group have been experimenting with a number of specimen cars that mark a radical departure from what has long been accepted as the London standard of practice. The first effort in the production of a tramcar adapted to the peculiarities of London traffic was the construction in 1926 by the Metropolitan Electric

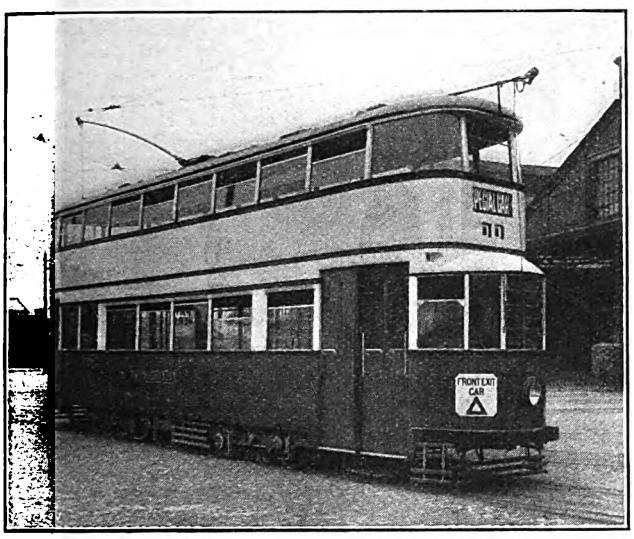

Fig. 1.—An Improved Tramcar.

Tramways, Ltd., of an experimental car, whose salient features were large loading capacity; lightness of construction; low centre of gravity, attained by the adoption of small-wheel bogies; a one-level floor from end to end of the lower deck; roomy end-vestibules, with doors at each side; front exit; and semi-enclosed driving cabs. A second car, differing somewhat in design, was subsequently put into operation on the system of the London United Tramways, Ltd., and the experience gained in the operation of the two model cars pointed the way to further improvements, with the result that the Union Construction & Finance Company of Feltham was commissioned to build two additional cars of the all-enclosed double-deck type with a streamline body having a slightly turnunder waist punch and tapering sides above the waist line. The first car, a 64-seater, was placed in operation by the M.E.T. a few months ago and the second, a 62-seater, has now commenced to undergo service tests on the same system.

The body is carried on a steel underframe and the framework of the two saloons is one unit, riveted to the underframe. The exterior sheets, including those of the roof, are made of aluminium and the dash-panels of high-tensile aluminium plate, having the special advantage of lightness. The waist panels, quarter panels, and roof panels, are lined with loose-woven canvas to deaden noise and drumming when the car is in motion. Although the car exceeds the usual length of double-deck bogie cars, its weight is practically the same as the weight of the latter, being only 17 tons. The car is mounted on maximum traction bogies having 28-in. driving wheels; the exterior width of the lower saloon is 7 ft. 2¼ in., thus enabling double cross seats to be used in that compartment; the tapering sides of the top deck increase clearance, and the end of the car has been nosed to avoid excessive overhang at curves (fig. 1).

The car has been designed for fare collection on the "pay-as-you-pass" principle; the staircases rise in the reverse direction to the usual one and abut in the extremities of the upper saloon (fig 4); they thus occupy part of the vestibules, which compartments have an area of 30 sq. ft., the arrangement facilitating the issue of tickets to passengers making for the saloon. Hitherto, the "pay-as-you-pass" system has been in force only on one-man cars of the single-deck type, the passengers boarding at the forward platform.

The conductor of the new car sits in the rear vestibule (fig. 2) before a ticket-issuing machine and collects the fares as passengers board the car. By remaining seated he can more satisfactorily control the movements of the car and signals to the driver, thereby affecting a speeding up in actual operation, it is claimed; also passengers will no longer be disturbed by the conductor moving about the car during the journey.

In the space under the staircase in each vestibule (figs. 2 and 3) are disposed the motor resistances, sand-hoppers, and air engines operating the exit doors. The doors of the cabinets have louvred fronts, and are fitted with electric radiators.

On one side of each vestibule are two double-hinged doors (fig. 3) and on the other side a sliding door. The former provide two clear openings of 2 ft. 3 in., are hand operated, and can be kept open by means of a catch or locked when closed; attached to the base are hinged flaps which close-in the platform step as the doors are shut. Each door is a one-piece casting of aluminium silicon alloy, glazed. On the rear vestibule of the car the doors will be used for both boarding and alighting. The sliding door, which provides an opening 2ft. 4½ in. wide, is air-operated, and the one in the forward vestibule will be used for the egress of passengers. It is controlled by the motorman and interlocked with the traction circuit, so that the car cannot be started until the door is closed. The sliding doors are built of aluminium sheets on a light wooden framework.

The driving cabs are separate compartments, partly projecting from the ends of the car. The controller and other apparatus are enclosed in cabinets and, to permit of operation whilst the motorman is seated, the controller is of a dwarf type. All the glasswork is of a safety type, and there is a louvred wind-screen, which the motorman can adjust as suits him.

The total capacity of the car, including standing passengers, is 78; the lower saloon seats 22 passengers. The seats are all of the cross-type and have slightly shaped backs, being sprung and upholstered overall in moquette. The reversal of the backs, the uprights of which are in the mid-section of the seat to allow maximum width, tilts the seats. Artificial lighting is afforded by 16 frosted bulbs, with vitreous enamel reflectors. Electric bell-pushes of chromium-plated metal are disposed in convenient positions. To ensure adequate ventilation certain of the windows are of the "Windsor" half-drop type, the upper light sliding down outside the lower one.

The upper saloon (fig. 4) accommodates 40 passengers and, with the exception of a side seat for four persons at each end, all the seats are of a cross-type similar to those in the lower saloon, but the upholstery is pantasote. The artificial lighting and windows are similar to those of the lower saloon. Ventilator devices are provided in the roof.

The 60-h.p. motors are of the B.T.H. 509 pattern and the controllers of the B.T.H. B527B type. In conjunction with the controllers, the car is fitted with line-breakers and an

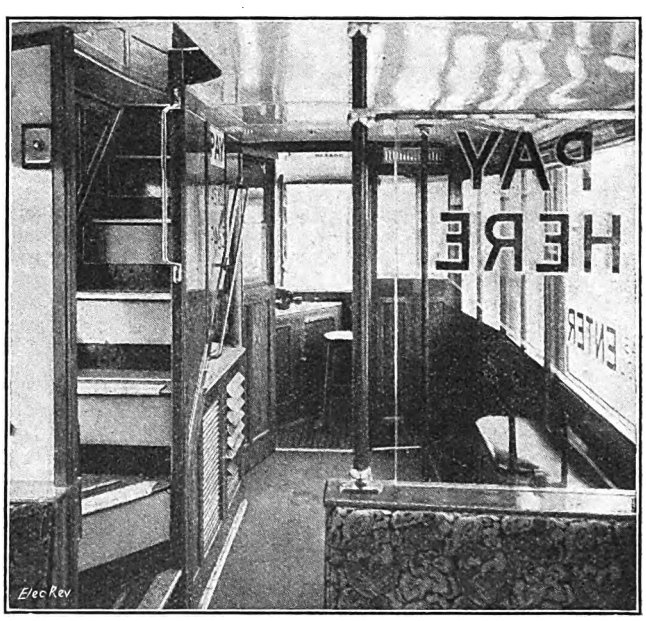

Fig. 2.—Platform and Standing Area.

overload relay on both poles, as well as with field-shunting contactors operated by an auto shunt-relay, which comes into operation on the last parallel point of the controller. The controllers have five series, four parallel, and seven brake notches. Two trolley booms are provided, one for the "up" and the other for the "down" journey, so that the necessity of swinging round a boom and putting the car in darkness at the terminals is obviated.

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In addition to the usual hand-brake and magnetic track-brake, the car is fitted with the British Air-Brake Company's standard straight air-brake equipment. The motorman's brake valve controls also the sanding apparatus by means of a thumb button. Compressed air is supplied by a KLL 1-type

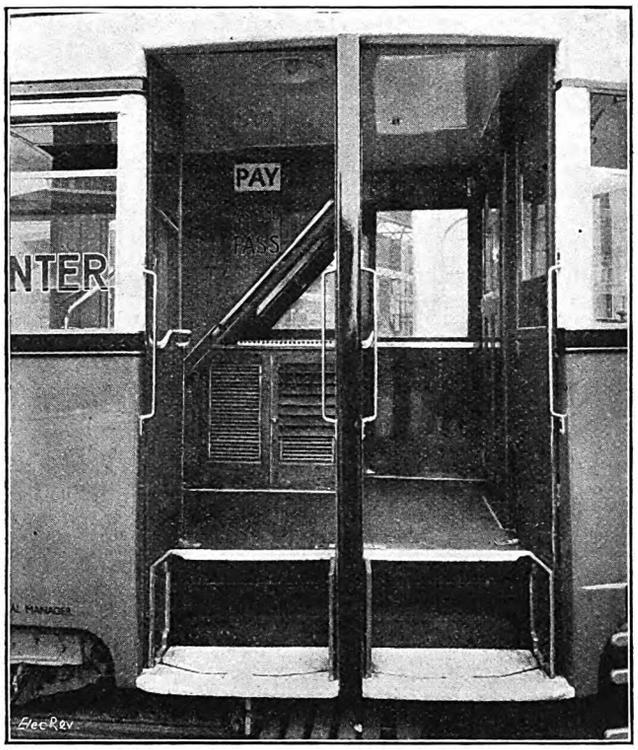

Fig. 3.—Rear-end Entrance Doors.

2-stage rotary compressor, giving a maximum of 8.6 cu. ft. of air per minute at 100 lb. pressure per sq. in. It is directly coupled to a 500-volt d.c. motor, the whole being totally enclosed and suspended under the car. The brake gear is applied to all the eight wheels of the bogies.

The motorman is allowed to use his discretion as to which brake he uses: the air brake has the advantage of giving a smooth stop up to 4 or 5 ft. per sec. per sec., and the magnetic one up to 8 or 9 ft. per sec. per sec., so that in practice the air brake (which does not cause rail wear) is used for ordinary service stops and the magnetic one in an emergency. The London speed of over 10 m.p.h. is the highest average speed for tramcars of any city and calls for particularly good brakes. An electrically-operated device is fitted to the air cylinder to make the air brake inoperative, while the magnetic one is in use, so that the wheels will not pick up. A distinctive

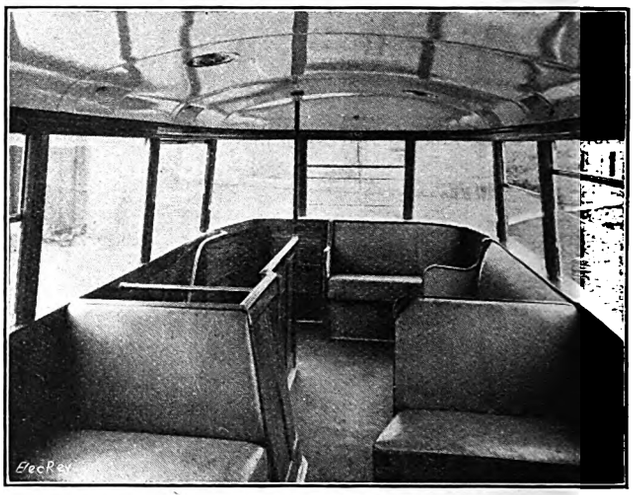

Fig. 4.—Top Deck Saloon.

feature of the magnetic brake is that is less likely to cause skidding.

The principal dimensions of the car are as follows:—

	ft.	in.
Length, over spring bumpers	40	6
Length, inside lower saloon	16	3⅝
Length, inside upper saloon	37	7
Width, over waist-rail lower saloon ...	7	2¼
Width, inside lower saloon	6	7⅞
Height, from rail to top of roof sheets ...	15	0¼
Height, inside lower saloon	6	2 11/16
Height, inside upper saloon	5	11

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

A Hotel-fire Charge Collector.

A recent introduction of Electrical Utilities, Ltd., Tudor Works, Park Royal, N.W.10, is a simple and robust instrument to take the place of the prepayment meter for use with electric fires in visitors' rooms of hotels, &c.

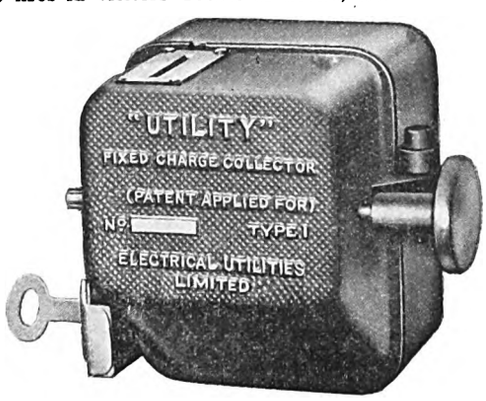

Fig. 1.—" Utility " Hotel-fire Charge Collector.

It consists of a 15-A (in the case of the standard apparatus) tumbler switch contained in a cast-iron case, with a glass window at the base, not visible in the illustration, fig. 1. When the user places 1s. in the slot, and pulls the handle over, the coin forces the switch in the " on " position, in which position it remains until the following morning, when the chambermaid or " boots " unlocks the case, takes out the coin, and resets the gear. This enables the consumer to get a fire for a similar charge to that which is normally made for coal fires in hotel bedrooms, which satisfies the hotel proprietor. Larger patterns for controlling bigger fires, and others for taking any number of coins, such as sixpences or florins, can be supplied.

New Locking Washers.

The prevention of loose connections is a matter of vital importance to the electrical and radio industries. To give absolute security and permanent positive contact, a new locking principle has been devised which is applicable wherever a screw, nut, or terminal is used in electrical or wireless production. The " Shakeproof " lock washers and locking terminals produced by Messrs. Barber & Coleman, Ltd., Brooklands, Manchester, are made of tempered spring steel or phosphor-bronze, have a twisted tooth form which bites into both the contact surfaces, and when secured with the screw, nut, or terminal can only be loosened by applied force. Vibration only causes the teeth to bite deeper into the metal and form a more positive lock. The washers are multiple locking, spread-proof and tangle-proof and are made in sizes suitable for all requirements up to 1 in. screw sizes.

A New Cut-out.

The " Gardy " cut-out, a production of the Apparaillage Gardy S.A., of Geneva, which is represented in this country by Messrs. Thompson & Co., 1 and 3, Old Swan Lane, E.C.4, has been designed so as to obtain as small overall dimensions as possible, although sufficient room is left to allow practical fixing of the conductors. The construction of the cut-out is

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shown in fig. 2. It is of the pin-contact type, and has a porcelain base A and a cover B. The latter covers completely the "live" parts. The connection device for the neutral link has been patented. The neutral conductor is fixed to both terminals D and E which are connected by the movable connection F. To disconnect the neutral conductor, it is sufficient to unscrew slightly the screw G and the threaded cap, and to turn the link round the point G. This disconnection can only take place when the fuse has been withdrawn from the cut-out, and the cover cannot be fixed on the base unless the movable connection is again in place. The cap H is independent of the wire terminal screw, which serves to fix the neutral conductor on the terminal D, so that it is unnecessary to disconnect the conductor fixed to the terminal E in order to disconnect the movable bridge. This cut-out can be used for group mounting on bus-bars, in which case the slots J and J_1 serve for the passage of the bars. In this case the screw G is replaced by a special and longer screw, which is fixed directly in the corresponding bar. Back mounting is provided for by fixing threaded pins in the terminals D and E. The company also supplies the cut-outs in s.p. type.

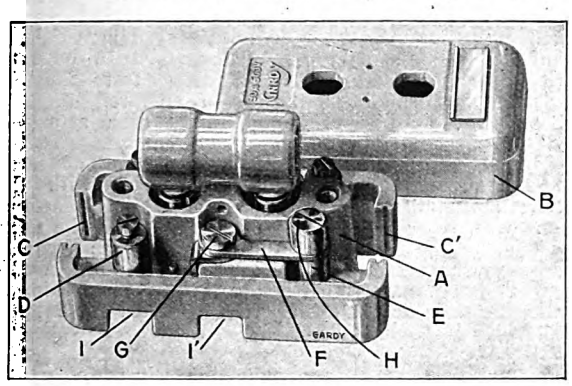

Fig. 2.—The "Gardy" Cut-out.

A New 20-cwt. Electric Lorry.

ELECTRICARS, LTD., of Lawley Street, Birmingham, have lately brought out a new 20-cwt. electric chassis, which can be fitted with either a lorry or a van body. The new vehicle is intended for use for the delivery of bottled milk, mineral waters, beer, bread, or other materials necessitating a large number of calls in a comparatively short journey. Outwardly it has the appearance of a petrol vehicle, the battery of accumulators being carried under the bonnet at the front. The motor, which is of the duct-ventilated series-wound traction type, is located at about the centre of the frame and drives the back axle through a tubular propeller shaft and worm gearing. The controller, which is located within convenient reach of the driver, is adapted to give three speeds in both the forward and reverse directions. A feature of the vehicle is the shape of the side members of the frame, these being dropped at the front end to give a low floor-level for the driver and his mate, and thus to facilitate their frequent dismounting when delivering goods. The vehicle has a wheelbase of 10 ft. 3 in. and a track of 4 ft. 8 in. As a lorry the loading area of the platform is 7 ft. 9 in. by 5 ft. 8 in., while as a van, 190 cu. ft. of loading space is available. With the standard battery the machine can travel on straight runs from 27-30 miles on one charge, and a run of 18 miles which includes 100 stops can be achieved, the maximum speed on the level with full load being 12 miles per hour.

A Cable Stripper.

The "Fermo" cable stripper, fig. 3, is designed to provide an easy means of removing the insulation from the ends of electric cables. Its operation is self-explanatory from the illustration. The tool is made in three sizes, each of which covers a wide range of wires, and is manufactured by the FERMO Co., Hale Road Bridge, Altrincham.

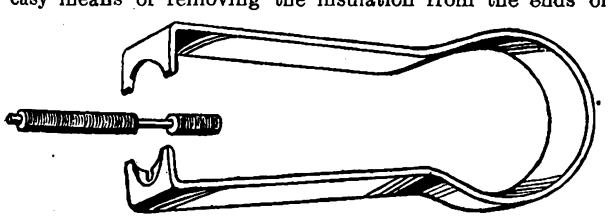

Fig. 3.—The "Fermo" Cable Stripper.

New Lighting Fittings.

The "TYPERLITE" COMPANY, 86, Cannon Street, London, E.C.4, which is the maker of "Typerlite" lighting units for use in offices, works, &c., is introducing a further selection of useful models built up of "Typerlite" interchangeable components. Fig. 4 shows a new type of heavy desk standard finished in bronze colour, with a rise and fall adjustable top. The standard is fitted with a specially designed trough reflector coloured to match the body of the fitting. The base contains a pen rest and two removable receptacles for use as ash or pin trays. A second "Typerlite" is adapted for use with an accounting machine, while another model is a floor standard for use in hospitals, nursing homes, &c., with an exceptional range of adjustability. The body of the latter is finished in white vitreous enamel, with nickel-plated components. For easy and silent transportation the fitting can be mounted on a specially designed trolley fitted with three rubber-tired all-directional ball-bearing casters. A useful and novel form of "Typerlite" component is the specially designed universal ball socket joint which can be readily adapted for use with any existing "Typerlite" fitting. With this adaptation the head of the fitting is enabled to be given an all-directional adjustment over 360 deg.

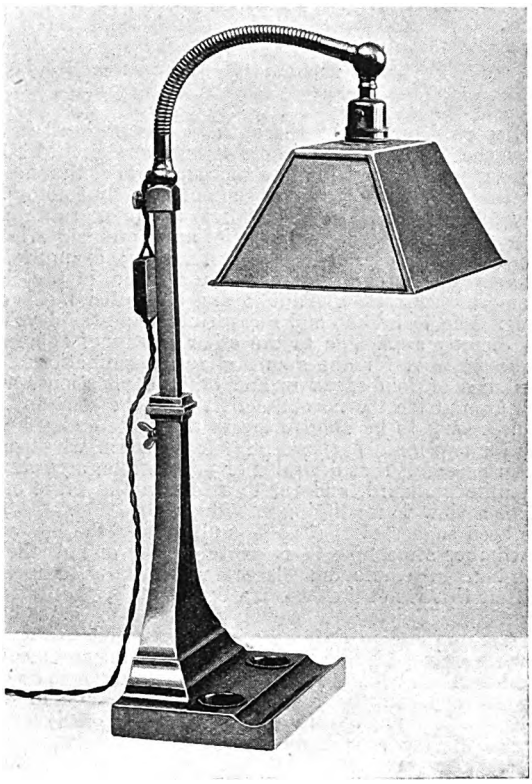

Fig. 4.—Heavy Desk "Typerlite" Standard.

A Small Searchlight Projector.

A small searchlight projector mounted on a tripod, with extensible legs, fig. 5, has been produced for prospecting work in connection with mining by the LONDON ELECTRIC FIRM, Brighton Road, Croydon. Tilting and training motions are provided with easy manipulation. The tripod is very rigid and will extend sufficiently to bring the centre of the light just over 6 ft. from ground level. The lamp is arranged for taking 13 to 14-volt lamps fed from a small accumulator in a wood case, and the whole equipment can be carried by one man.

Fig. 5.—Searchlight for Prospecting Work.

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Noise Emitted by Machinery.

The Analysis and Measurements Involved in a Comprehensive Investigation of the Subject.

By B. A. G. CHURCHER, M.I.E.E., and A. J. KING, A.M.I.E.E.

(*Summary of a paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE work described by the authors was initiated in 1926 by the Metropolitan-Vickers Electrical Co., Ltd., with the object of attacking in a thorough and comprehensive manner the problem of the noise emitted by motors. A definitely higher standard in respect of quiet running in general is greatly to be desired, as the noise problem arises in many other types of engineering apparatus; examples are transformers and integrating meters for domestic use, large generators and converting plant, gears, and other mechanical apparatus. The technique and measuring apparatus developed are also directly applicable to the other classes of apparatus; it can also be used for the quantitative determination of the characteristics of loud-speakers and other applications, many of which are outside the normal activities of the company.

It is necessary to be able to assess the noise emitted by a machine for two main purposes: (*a*) to ascertain whether the noise is in excess of that desirable or permissible, according to some definite standard, and (*b*) to ascertain the cause of the noise with a view to modifying or reducing it.

It has been suggested that as it is ultimately the ear which judges whether a machine is excessively noisy or not, there is no advantage in employing elaborate apparatus to measure noise. That this is not the case can be shown by the following considerations. Suppose a person is asked to listen to a machine for purpose (*a*). If he merely says that the noise is or is not excessive, his judgment will satisfy no one but himself, and he will be asked to be more explicit; to be so he must consider the noise in the two aspects of pitch and intensity or loudness. The average unmusical person can only express his sense of the pitch of simple sounds by such terms as very low, low, high, very high, and so forth, but some musicians have a keen sense of absolute pitch and can judge the pitch of an isolated note to within a semitone, *e.g.*, to within 5 per cent.; that is, however, a rare accomplishment. Then the sense of loudness of simple sounds can only be vaguely expressed and, in practice, the sounds emitted by machines are nearly always complex in character; that is, several pitches are present simultaneously. It is then usually very difficult to pick out the pitches of the several components unless a few are particularly prominent, and it becomes even more difficult to judge loudness.

Thus, while the ear is an exceedingly sensitive and discriminating detector of sounds, it cannot yield the quantitative information required for purpose (*b*). As with other engineering quantities, it is necessary to deal with sound on a basis of measurement in terms of a definite standard, rather than on the basis of the opinions of individuals. While physical quantities must be the medium by which sounds are measured and represented, the physiological aspect of the matter, namely, the susceptibility of the average ear to sounds of different kinds, must be given due consideration. This is particularly important when considering limits for the sound it is permissible for a piece of engineering apparatus to emit. Such limits must, of course, be fixed with reference to the physiological effect produced by the sound, and in that sense the average ear constitutes the fundamental standard. Physical measurement is necessary, however, in order to obtain quantitative results, to eliminate the vagueness of individual judgment, and to analyse complex sounds. In common with other physical measurements, it is a great advantage if the results can be expressed in absolute units under clearly defined test conditions, rather than in arbitrary units associated with some particular test method or apparatus. If this is achieved, the use of different types of apparatus by different investigators will not prevent their results being compared.

The occurrence of sound involves the action of three elements: the sound generator, which is essentially a vibrating body, consists of the apparatus under test, the air is the transmitting medium, and the ear or the acoustic element of a sound-measuring apparatus constitutes the sound detector. The physical magnitudes involved in the measurement of the sound set up by a vibrating body are discussed generally, together with the characteristics of the ear. The characteristics that should be possessed by sound-measuring apparatus intended for use in engineering problems are pointed out, and a brief survey is made of existing types of apparatus. The principle, development, and final form of apparatus which enables a complete analysis of a complex sound to be made are described, together with the methods employed to verify the accuracy of the apparatus. The influence of the conditions under which sound measurements on engineering apparatus are carried out is discussed, and a special laboratory which has been set up for acoustical work is described. Some sound-test results on engineering apparatus are given as examples to illustrate the kind of results that may be obtained with various types of apparatus taken quite at random. While it should not be assumed to be representative of its class, the following test illustrates those made on small motors in a non-reflecting test room. The distribution of sound round such a machine is by no means uniform in all directions, so it is necessary to take readings on all sides and at several distances. Having obtained the frequencies with their respective amplitudes, the next step is to try to associate each one with some part of the machine. Since the sounds are peculiar to the rotation of the machine, each frequency is divided by the speed (rev. per sec.) of the rotor. A series of numbers is obtained which is very helpful in tracking the component sounds to their respective sources; for instance, the following are easily identified:—

Frequency of note.	Frequency ÷ (rev./sec.).	Corresponding to.
225	9	Nine blades on fan.
675	27	3rd harmonic of fan note.
1,120	45	45 rotor slots.
100	—	Vibration of punchings, twice supply frequency.

In order to keep the paper within a reasonable length, the authors confine themselves to the discussion of methods of measuring noise emitted by stationary machinery, which is a necessary preliminary to any systematic investigation of the subject. Since the paper was written, wide experience has been gained in the interpretation of the results of measurements on machines of various types, their correlation with the design data of the machines, and the measures which are effective in removing excessive noise, the discussion of which matters is beyond the scope of the present paper.

Discussion.

Broadly speaking, two conclusions might be drawn from the discussion on the paper: first, how little the average electrical engineer knows about noise and its prevention; secondly, how much information on the subject is welcomed. It might be said that most of the speakers dealt with the subject from the viewpoint of the physicist rather than of the electrical engineer. There was a general expression of congratulation to the Institution on having the paper read before it, the subject, although of great importance to electrical engineers, being essentially a physical one. The fact that at least one electrical firm was dealing with the subject of noise was also commented upon. There was very little real criticism of the paper, although much highly technical information was imparted by various speakers, coupled with requests for further information. It was very interesting to learn that similar work to that of the authors which had been started in America and abandoned, as being unlikely to give useful results, had been restarted as the result of the authors' work. Several speakers referred to examples of similar apparatus which had been in use for some time. The main criticism centred round the use by the authors of a moving-coil microphone in their test apparatus. Did not the moving-coil instrument lead to induction troubles? The m.c. apparatus was adopted because it lent itself to calculation, but was not the method of calculating and then checking rather putting the cart before the horse? There was also some difficulty in seeing why driving machinery round should produce the same sort of noise as knocking it with a hammer.

The interpretation of the author's results appeared to trouble several speakers, and there were complaints to the effect that the results did not offer any practical information, while such questions as "what amount of noise is permissible" were asked. Another point which concerned several speakers was the influence of a mixture of noises at different frequencies, and it was urged that the intermingling was the most urgent and difficult problem to be dealt with.

Some interesting details of a test on noise from the outside taken in a P.O. official's office were given. At first ½ dyne per sq. cm. pressure was obtained with high frequencies; when the room was given a false ceiling the pressure was reduced to half, and the frequency was found to be comparatively low—500 cycles. The noise from a typewriter was found to have a frequency above 2,000 cycles.

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The Blowing of Fuses.

The Pressure Produced on Blowing Electric Fuse Links and Striking Electric Arcs in Closed Vessels

IN the Safety in Mines Research Board papers Nos. 38 and 39 experiments were described regarding the pressures produced on blowing electric fuse links and striking electric arcs in closed vessels, using currents up to 1,350 amperes at 575 volts. The present paper* deals with results obtained with currents up. to 10,000 amperes at 600 volts d.c.

Three principal series of tests have been carried out, with the results outlined below.

Results of Experiments.

(*a*) *The Effect of Current Strength on the Pressure Produced on Blowing a Fuse Link of Copper Wire in a Closed Vessel.*— For this series of experiments fuse links (free length 4½ inches) of tinned copper wire of 13, 16, and 18 s.w.g. were blown by currents ranging from 740 to 9,700 amps. at 600 volts.

Since the electrodes entered the fuse-box horizontally and the fuse link was stretched vertically between them, a U-shaped loop was thus formed which acted to a certain extent as a magnetic blow-out. The total force perpendicular to the fuse link, acting outwards due to the magnetic field between the electrodes, was calculated to be $0.041\ I^2$ dynes $= 0.0924\ I^2$ lb. wt. (I being expressed in kilo-amps.). Thus, for values of I of 750 and 10,000 amps. the force was 0.52 and 9.24 lb. wt., respectively. With fuse carriers in general, although a strong blow-out effect may be induced by the disposition of the leads and contacts, it is prevented from being operative by the fuse link container. In the present experiments, however, it is probable that the blow-out effect contributed in some measure to the extinction of the arc.

Using 18 s.w.g. tinned copper wire fuse links, it was found that the increase of the blowing current effected a marked reduction in the arcing time. The arcing energy and the maximum pressure developed increased with increase of current, but the most pronounced effect was on the rate of rise of pressure.

The behaviour of the 16 s.w.g. wire fuse links was similar to that of the 18 s.w.g. wire, except that the maximum pressure and arcing energy varied between somewhat wider limits. The 13 s.w.g. wire yielded slightly higher maximum pressures and arcing energies throughout its range, but the pressure-rise was more uniform.

The thinnest wire was volatilised almost instantaneously, causing a rapid development of pressure within the vessel. The thicker wires took longer to melt and vaporise, so that the rate of rise of pressure was slower. The times from closing the contactor to the start of arcing with short-circuit current (resistance of circuit 0.0376 ohm., plus the resistance of the fuse link) were as follows:—

13 s.w.g.	0.0216 sec.
16 s.w.g.	0.0081 sec.
18 s.w.g.	0.0046 sec.

The 4½-inch length of fuse link satisfactorily cleared the arc in each instance.

(*b*) *The Effect of Arcing Time on the Pressure Developed.*— The arcs were started by bridging a ⅝-inch gap between ½-inch diameter brass electrodes with one or two strands of 23 s.w.g. tinned copper wire. The circuit employed was the same as for the experiments with fuse links. Considerable difficulty was experienced at the outset in maintaining the arcs for more than 0.25 sec.,† and it was not until inductance was added by including a coil in the circuit that it was found possible to maintain an arc for 0.4 sec. or longer. The inductance of the coil, calculated from the time-constant of the circuit, was 0.000283 henry.

For a constant initial arcing current the maximum pressure increased with the duration of arcing, but the relationship was not linear. With arcs of long duration, the rate of rise of pressure diminished, and throughout part of the arcing time the pressure remained nearly constant, showing that equilibrium had been established between the production and condensation of metallic vapour.

The results in general show that for an arc of 4,000 amps. maintained during 0.05 sec. the pressure in a closed vessel of 400 cubic inches only reached about 60 pounds per square inch. The highest pressure recorded in thirty tests was 133 pounds per square inch, and was produced by an arc maintained for approximately half a second. With a vessel of the capacity used, there would appear to be little danger of serious pressures on a 600-volt system with currents up to 4,000 amps., provided that an adequate circuit-breaker is included in the circuit. The danger from prolonged arcing seems to lie more in the possibility of the arcs striking to the enclosing vessel and melting it than in the generation of pressure.

(*c*) *The Effect of the Rate of Pressure Rise and on the Maximum Pressure Developed on Explosion of a Methane-Air Mixture when Ignition is by Blowing an Electric Fuse Link.*— It was decided to blow fuse links of 13, 16, and 18 s.w.g. tinned copper wire in 10 per cent. methane-air mixtures by (*a*) short circuit currents, and (*b*) least available currents. The fuse box was evacuated by means of a pump and then filled with the firedamp-air mixture. The subsequent procedure was as for the experiments on blowing fuse links in air.

The pressure developed and the time for attainment of maximum pressure were independent of the diameter of the wire and of the arcing time for each current value throughout the range used. The time for the attainment of maximum pressure was, however, reduced as the current was increased. At the same time there was a slight increase in the maximum pressure, but this increase was by no means incomparable with that observed on blowing the same size of wire in air by short-circuit current in comparison with the least available current. This bears out the conclusion reached as the result of earlier experiments with smaller powers that the maximum pressure produced when an explosive mixture is ignited by blowing a fuse link is not the sum of the maximum pressures due separately to the gas explosion and to the blowing of the fuse link. The present experiments also confirm the observation that arcing when an explosive mixture is present is of shorter duration than when the fuse link is blown in air.

(*d*) *The Effect of the Volume of the Fuse-box on the Pressure Produced, the Arcing Time, and the Arcing Energy.*— Fuse links of 13 and 18 s.w.g. tinned copper wire were blown in closed vessels of 400, 284, and 150 cubic inch capacity by short-circuit currents at 600 volts d.c. and by currents of about 2,800 amperes at 600 volts d.c.

With the short-circuit currents it was found that the volume of the fuse-box had but little effect on either the pressure produced, the arcing time, or the arcing energy, whereas all three tended to increase as the volume of the fuse-box was decreased when currents of about 2,800 amperes were used, particularly in the series of experiments with 18 s.w.g. wire. The increase in the arcing time in these experiments was found to be due to the deposition of a film of copper on the walls of the fuse-box, along which the current passed, the arcing path being then less than between the electrodes. In one experiment the arc was maintained during more than 0.5 sec., after which time the circuit-breaker cleared it.

Conclusions.

For the conditions under which the tests were carried out, it was found that the blowing of unenclosed fuse links of 13, 16, and 18 s.w.g. tinned copper wire entailed no dangerous development of pressure in a closed vessel of 400 cubic inch capacity suitably insulated. In these tests a 4½-inch length of wire was sufficient to clear the arc no matter what the current flowing in the circuit when the circuit was nearly free from inductance.

The chief source of danger with such an arrangement of open fuse links as was employed was found to be failure of the insulation of the casing, with the establishment of an arc which might melt the casing.

The rate of rise of pressure increased with the blowing current for a given size of wire.

The pressure in a closed vessel due to maintained arcs varied with the arcing time for constant current but tended towards a limiting value, dependent, apparently, on the extent to which the vaporised metal was cooled by the vessel. The pressure developed during the time taken for the average circuit-breaker to operate (about 0.02 sec.) was found to be of no serious magnitude under the conditions of gap length and container volume used.

When fuse links were blown in explosive atmospheres of methane and air, the maximum pressure was independent of the blowing current, but the rate of rise of pressure increased with the blowing current.

The volume of the fuse-box had but little effect on either the pressure produced, the arcing time or the arcing energy when short-circuit currents were used with 13 and 18 s.w.g. tinned copper wires, but all three tended to increase with decrease in volume of the fuse-box when the blowing current was about 2,800 amperes. The increase in arcing time was found to be due to the deposition of a film of copper on the walls of the fuse-box, whereby the arcing path was reduced.

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* Safety in Mines Research Board, paper No. 52. (H.M. Stationery Office, 1s. net.)

† This may have been due to the magnetic blow-out effect of the leads, as very much greater lengths have been maintained "free in air" when this effect was absent.

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Bradford Engineering Exhibition.

Features of the Electrical Exhibits.

THE Bradford Engineering Exhibition, which incorporates an Industrial Electric Heating Section organised by the Electrical Development Association, was opened at the Olympia Hall, Bradford, on November 6th; it will remain open till November 16th. The exhibition covers many phases of engineering, but electrical equipment occupies a larger share of the space and attention than any other single branch of the engineering industry. The exhibition is much more in the nature of an industrial engineering display than domestic, and the electrical stands are equipped mainly on this aspect. The City of Bradford Electricity Department has by far the biggest amount of space of any exhibitor in the show, occupying a successive block of ten stand spaces, in addition to space on the stand of the English Electric Co,. Ltd. On the general stand of the Department is apparatus of various kinds, descriptive matter, and diagrams showing the method and principle of generation and distribution of electrical energy for all purposes in connection with public electricity supply, from the coal fuel in the railway trucks to the utilisation of the electric current in transport (with a model electric tramway system), street and domestic lighting, power, heating, and cooking, &c. The stand—by far the longest frontage display in the whole exhibition—is illuminated by electric lamp standards, as for street use, dividing each of the compartments from its neighbours.

A View in the Exhibition Hall.

Leeds Electrical Construction Co., Ltd., are showing their "Lecfur" electric furnaces, operating at temperatures up to 1,350 deg. C., with associated automatic control gear for controlling temperatures at any pre-determined setting. Hopkinsons, Ltd., have a comprehensive show of their steam valves and mountings for adaptation to most industries. Messrs. Young, Osmond & Young, Ltd., have a stand showing the "Unity" electric heating system for works, factories, special process rooms, petrol depôts, &c., and other "Unity" heaters. Browns' Dryers, Ltd., are displaying their electric-oil heat-storage system for improvement of load factor, in which oil is the medium for storing heat instead of the more usual medium, water. They claim that, bulk for bulk, the system can deal at atmospheric pressure with five or six times as much usable heat as a water-storage system under the same conditions. The stand of the Bastian Meter Co., Ltd., is attracting much attention by reason of the display of "Masarini" electro-steam boilers and hot-water electrode calorifiers for water heating and steam raising on a large scale for use in ships, hospitals, public baths, &c., or on a small scale for domestic uses. This firm is also showing electric fires and radiators, the latter both for the home and for industrial works.

The United States Metallic Packing Co., Ltd., has a display of engineering packings for many purposes, and is showing also its "Bradford" electric hand drills. The Roto Engineering Co. (Bradford), Ltd., has on show electric fans for all purposes, including the Firth Staybrite Ozonair (oxygenised air) apparatus, dust and fume removal plant for the wool trade, and electric and acetylene welding. The Airedale Electrical and Manufacturing Co., Ltd., is featuring alternating current industrial-type ironclad switchgear, comprising ironclad unit-type switchboards; oil-immersed circuit breakers; air-break and oil-break auto-transformer starters; air-break and oil-break stator rotor starters for slip-ring motors; air-break and oil-break star-delta and series-parallel starters; and air-break switches of various types with automatic features. British Resistor Co., Ltd., is showing, among other items, a small "Globar" electric furnace, in operation at a temperature of 1,350 deg. C.; a "Utility" electric paint burner; a "Globar" electric grill for industrial requirements; and photographs of their large furnaces for industrial uses.

The Premier Electric Welding Co., Ltd., has exhibits comprising welding transformers and regulating choke coils for alternating current of all periodicities; "Premier" electrodes for welding mild steel; examples of "Belfinish" welds and electrodes; "Flexin" welding tool and welding electrode; and the "Premag" copper welding process. Lang Bridge, Ltd., stressing the desirability of electricity as a heating medium, has on show its electrically-heated drying cylinder for use in the bleaching, dyeing, and finishing of textiles.

The Jackson Electric Stove Co. is showing a two-deck pastry oven; 4-ft. hot cupboard; 24D. cooker; wash boiler, as hired out by the Bradford Electricity Department; electric cooking cabinets and fires complete; cooker and fire elements assembled and dismantled, with typical wiring connections for cookers; and a switchboard showing the arrangement for obtaining series-parallel-control. The General Electric Co., Ltd., has a striking display with its double-deck electric bread oven and double-deck pastry oven for bakehouses. The Ferranti stand is given over to electric fires (showing details of construction); water-heating equipment, also showing constructional details; control equipment for water heating; thermostats, relays, and other instruments. Jessop & Boydell, Ltd., have an extensive display, covering two stands, of electrical testing instruments associated with the name Evershed & Vignoles, Ltd.; the new "Bridge-Meg" resistance tester; the "Megger" earth tester, in operation on a model of a sub-station with a transmission line; electrical indicators and recorders; the "Midworth" distant repeater (to repeat at a distance the movement of recording instruments on site and for actual distant control of machinery); electric salinometers and water-purity meters; the Ashdown rotoscope (to obtain slow-motion vision of objects in high-speed motion); and various types of automatic motor-control panels manufactured by the Igranic Electric Co., Ltd.

James Tate & Co., Ltd., have a stand devoted to their new electrically-operated 12-in. P.S. valve with automatic and independently controlled by-pass valve; Tate's electric stop-motions; and individual electric loom drives. Thos. Allan and Sons, Ltd., are displaying all types of cast-iron pipes for the engineering trades, and also featuring soft grey-iron castings especially for the electrical trades. A series of interesting exhibits on loan included a model of a sub-station—at present under construction for the Central Electricity Board—lent by Metropolitan-Vickers Electrical Co., Ltd., and a ½-kW turbo-dynamo set of 65 volts (constructed in 1889), a small unit lent by C. A. Parsons & Co., Ltd., and similar in construction to the first Parsons turbo-dynamo now in the Science Museum, South Kensington.

Electrical Contractors' (E.T.B.I.) Ball.

The London branch of the Electrical Contractors' Association (chairman, Mr. C. H. Flower) held a most successful ball on November 7th at the Portman Rooms, W.1. Over 500 tickets were sold for the benefit of the Electrical Trades Benevolent Institution, and a large proportion of the purchasers took part in the function. Dancing was varied by an auction, conducted by Mr. Ll. B. Atkinson, M.I.E.E., of articles donated by well-known firms for the benefit of the fund and by a cabaret entertainment.

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The Hams Hall Station.

Report of the Opening Ceremony.

THEIR Royal Highnesses the Duke and Duchess of York visited Birmingham on Wednesday last week, when upon the Duke devolved the duty of inaugurating the new electricity super-power station at Hams Hall (see our last issue). A very large company, representative of the civic life of Birmingham and of the electrical industry, was entertained at luncheon at the Grand Hotel, Birmingham, by the chairman (Councillor H. K. Beale) and members of the Electric Supply Committee. Those present included Sir Harry Haward and Sir John Brooke, representing the Electricity Commissioners; and Sir Andrew R. Duncan (chairman), Mr. Alderman W. Walker, Mr. Frank Hodges, Mr. R. H. Fox (secretary and solicitor), Mr. A. Page (chief engineer), and Mr. S. T. Allen (Central England engineer), representing the Central Electricity Board.

Councillor BEALE (who presided), in a brief review of the history of the Birmingham electricity undertaking, outlined the events that led up to the construction of the new station. Alluding to the change-over from the frequency of twenty-five to fifty cycles, he said the problem was a serious one. Birmingham had generating plant of over 200,000 kilowatts, and if they had to change-over it meant all that had to be scrapped, together with the manufacturers' plant dependent on the municipal supply. That was a very formidable question. Mr. Beale could not see that Birmingham itself was going to benefit in any way from the change, but the national point of view had to be considered. He wished to acknowledge how very much the Electricity Commissioners at first and then the Electricity Board had helped them in solving that very difficult problem. They had recognised that any great sudden disturbance would dislocate trade very severely. In the end they had come to an agreement whereby the change would be made gradually, and at the same time there would be sufficient plant, partly twenty-five and partly fifty cycles, to be able to supply those who had changed and those who had not without any risk of a breakdown. At Hams Hall extension was contemplated as and when it was wanted. The only limit appeared to be the quantity of water coming down the sewage carrier, which would increase as the city increased, and the success or non-success of their attempt to stop any nuisance from the chimneys, which was becoming a serious question in many parts of the country. The cost of the station, with accessories, was nearly £1,500,000. It was a fine station on the most modern lines, and they hoped it would produce a return which would be adequate, both from the national and local points of view.

Motor coaches were used for the conveyance of the guests from the Grand Hotel, Birmingham, to Hams Hall. The Duke and Duchess of York (accompanied by the Lord Mayor, Ald. Byng Kenrick, and other civic representatives) arrived about 3.20 p.m. His lordship presented to their Royal Highnesses Councillor H. K. Beale and Mr. R. A. Chattock (city electrical engineer). The approach road to the main entrance of the station was lined by ex-naval employés of the department, and a contingent of the local branches of the British Legion.

After an inspection by the Duke of the Guard of Honour, the Royal party was conducted into the engine room, and as they took their places on a raised dais, the National Anthem was played by the Birmingham Police Band. Miss Esther P. Chattock presented a bouquet of pink carnations to the Duchess. Councillor Beale then presented members of the Electric Supply Committee, officials of the department, and representatives of the contractors to the Duke and Duchess.

In extending a welcome to their Royal Highnesses, the Lord Mayor of Birmingham said that a great city population must live by the successful application of machinery to the production of saleable goods. The foundation of such success was the energy and skill of the people, but their most helpful ally would be a well-distributed supply of cheap power readily applicable to manufacturing processes. Since the year 1900 the production and sale of electrical energy in Birmingham had been in the hands of the Corporation, whose constant care had been to develop the supply in accordance with the needs of the city. The development has been rapid. The little station with which the supply began in Dale End had a plant capacity of 1,740 kW. To-day, with three stations within the city, and with the first section of a still greater station, the plant capacity of the undertaking stood at 260,000 kW. In 1900 three million units per annum was sold by the undertaking; ten years later the figure was 29 million units; a further ten years later it had increased to 129 million units; and to-day the annual demand was 314 million units. Bearing in mind that rapid growth it was not surprising that while the two machines to be put in operation were of 30,000 kW each, the station was designed to have an ultimate capacity of 240,000 kW. The station was already acknowledged as one of the selected generating stations for Great Britain

The Duke of York had a great ovation on rising to respond. He said that in developing the production and sale of electrical energy in Birmingham they were taking a great progressive step and one which was bound to leave an impression all through the country, for it meant the betterment of the health and welfare of the people. Birmingham had carried out its schemes with marvellous rapidity, and had earned the praise of all who had the public interests at heart. To see a magnificent power station like Hams Hall was an education in itself, and both the Duchess and he were much looking forward to seeing all that was to be seen.

Councillor Beale then invited his Royal Highness to inaugurate the supply of current at the power station by operating an indicator starting up one of the large turbo-alternator sets. The Duke moved forward a handle, and, amid applause, declared the station open. The Royal crown, surrounded by coloured bulbs (displayed opposite the dais) became a blaze of light, and a large inscription, "Success to the undertaking," arrested attention by its brilliancy.

The Duke accepted from Councillor Beale a silver-gilt model of the concrete cooling towers as a souvenir of the occasion, as well as an illustrated brochure of the station. A copy of this was also handed to the Duchess. His Royal Highness next unveiled a commemorative panel, in bronze, and, with the Duchess, he made an inspection of the power station. With this the interesting ceremony ended, and their Royal Highnesses then left for Birmingham (New Street station), returning to London.

Electric Power Supply.

The bearing that the progress made in, and the importance of, the electricity supply business has upon our national economy.

By G. R. J. Parkinson, M.I.E.E.

(*Extracts from the chairman's address read before the* SOUTH MIDLAND CENTRE *of the* INSTITUTION OF ELECTRICAL ENGINEERS).

OUR very existence as a nation depends upon our ability to export manufactures in competition with the rest of the world. Not only must our manufactures be of such quality and kind as to satisfy our clients, but they must also be offered at a competitive price. We are handicapped by heavy rates and taxes; the hours of work and rates of wages paid to our workpeople are, in many cases, higher than those of other competing nations; and our only chance of keeping abreast of our competitors is by reducing the cost of production. Rates and taxes we must leave to our politicians and hope for the best; a reduction of wages is out of the question, the present rates barely maintaining a reasonable standard of living; so we must look to the improvement of methods and the reduction of the cost of utilities, the most important of which are heat, light, and power.

They have to be derived from some natural source. Many countries have an inexhaustible supply available from the rivers, which can be obtained without drain upon the potential capital resources of the country. We in this country must look to our extensive coal deposits for our supplies of heat, light, and power, but it should be remembered that they are not inexhaustible; we are to an extent living on our capital, and it is our duty to posterity to see that we utilise our national resources with reasonable economy. The three utilities are universally required by every member of the population, and electricity is the ideal medium for obtaining them from the raw coal and conveying them to the individual consumer. Now, referring to the Board of Trade reports on the Census of Production, in 1924 roughly 50 per cent. of the power required in factories was obtained electrically, and of that one half was purchased from public supply authorities and one half was generated privately, so that only one quarter of the power requirements was met by public supply authorities. We can, therefore, look for a potential demand for that purpose alone four times as great at the output in 1924, independent of extensions and new developments. Railway electrification is another potential demand: whether or not our main lines are electrified, there is no doubt that we shall have large extensions of suburban-line electrification. Then, again, in electro-chemistry and electro-metallurgy we may look for considerable development. It is possible at the present time to convert iron ore into steel in an electric furnace and, although the process is not a commercial success at the moment, it is not improbable that an improved furnace, working on a continuous cycle and obtaining a supply at high load factor from a modern "selected" station, may be able to compete successfully with the blast furnace and convertor.

Lastly, there is the domestic consumer, including shops and offices, with a demand equal to one-third of the requirements of the country for all purposes. Domestic electrification is a somewhat contentious subject, and I am not convinced that the all-electric house is the ideal from a national economy point of view. I would divide domestic electrification into two sections: (*a*) including lighting, occasional heating, cooking, ironing, washing, ventilating, vacuum-cleaning, refrigerating, &c., and (*b*) the general heating of houses and hot-water supply. In the first section electricity offers enormous advantages from the point of view of convenience, cleanliness, health, and

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labour-saving, and can be supplied at a cost which compares favourably with those of other methods, but the second section is in a different category. Under the best conditions thermal efficiency in the production of electricity is only about 18 per cent. when reckoned at the consumer's terminals, whereas coke and coalite can be burnt in a closed stove for heating the house and water at a thermal efficiency of at least 50 per cent. General heating is only required for five or six months out of the twelve: on the one hand, if electricity were universally adopted for general heating, it would have a serious effect on the load factor of our generating stations and prevent that reduction of cost which we are all anticipating as the demand extends; on the other hand, if electricity were confined to the first section, occasional heating in the summer months would tend to equalise the summer and winter demands and thus improve the load factor. I am, of course, speaking in general terms: there are, no doubt, many instances in which both general and water heating, particularly if combined with thermal storage, can be, and have been, used with most satisfactory results.

It is now possible to reduce the coal consumption to less than 1½ lb. per kWh generated in the most up-to-date stations, but it does not appear probable that we shall be able to reduce that figure very much further without introducing such complications as would counterbalance the reduction, and I think we must look in the future for further economies by extracting and selling by-products by processes that can be conveniently combined with the generation of electricity. The low-temperature carbonisation of coal is essentially a continuous process that could be operated at 100 per cent. load factor, burning the whole output of gas and coalite on full load and storing the excess of coalite during light loads, the excess being sold to consumers for the general heating of their houses in the same way as the gas companies sell coke; the oil and tar recovered should more than repay the cost of carbonisation. Naturally, the quality of coal available and the relative cost of other fuel available in the district would require very careful consideration, but I do think that an electricity supply authority should be in a position to meet all the requirements of the public for light, heat, and power, and a combined system of carbonisation and electricity generation is ideal, both from national and personal economy points of view.

In 1927 some 180,000,000 tons of coal was consumed in open grates in this country, and of that total 40,000,000 tons was used by domestic consumers. The general use of coalite would not dispose of the inefficiency of the open grate, although it would make a big improvement in the smoky atmosphere of our towns and cities; but the public should be educated to make more use of the closed stove, combined with central heating and hot water supply. The open fire is a difficult problem, notwithstanding its many disadvantages, its inefficiency, the impossibility of providing a steady temperature, its labour-making propensities, and the scattering of dust and dirt, it has one advantage in that it induces excellent ventilation; moreover, the love of a good roaring fire is deeply implanted in the hearts of Englishmen, and this sentimental attachment will, I am afraid, continue to override all other considerations. Though we may succeed in persuading the public to adopt generally more economical and labour-saving methods of heating their houses, most families will still insist on retaining an open fire in their principal sitting room.

Owing to the large amount of water power available in Switzerland, from a national economy point of view it would be to the advantage of the Swiss people to use electricity for all and every purpose, but, notwithstanding their intensive electrical development, they cannot obtain electricity for general heating purposes at a price comparable with the cost of coal, and in most of their hotels and large buildings they use coal or coke for central heating and electricity for lighting and all auxiliary purposes. At the present time there is keen competition between gas and electricity authorities, which has been of undoubted advantage to the public and has led to most of the improvements in both means of lighting; but it is not economical to have two systems of distributing power, light, and heat, involving double sets of distribution mains and services and administrative charges, and healthy competition has often developed into rampant antagonism. Some day we may see gas and electricity authorities working together, the gas department taking the responsibility for the carbonisation and leaving the electricity department to generate and distribute electricity and coalite to meet all the requirements of the public.

B.S.S. for Phosphor-bronze Bars or Rods.

A specification for phosphor-bronze bars or rods has recently been issued by the British Engineering Standards Association. This specification is drawn up on parallel lines to the specifications for brass bars published in 1926, and covers round, square, and rectangular bars from ¼ in. to 2 in., and hexagon bars for standard nuts from No. 3 B.A. to 1½ in. B.S.W., and 1⅜ in. B.S.F., with specified margins of manufacture. The chemical composition of the material, mechanical tests, and the procedure of selecting samples for these tests are laid down. Copies of the Specification No. 369-1929 can be obtained from the British Engineering Standards Association, Publications Department, 28, Victoria Street, London, S.W.1, price 2s. 2d. post free.

Commercial Motor Show.

Brief notes on some of the exhibits of an electrical character.

THIS season's Commercial Motor Transport Exhibition (Olympia, November 7th to 16th) is the ninth of the series organised by the Society of Motor Manufacturers and Traders, Ltd. While the larger representation is that of vehicles whose power is provided by the petrol engine, steam-driven vehicles and a few electrically-propelled ones are on view, whilst the newer crude-oil engine is also represented.

The exhibition includes the products of foreign makers and of several manufacturers new to this branch of the motor industry. The number of exhibitors (totalling 380, of which 70 are vehicle makers) has increased by 40 since the last of these biennial events, and accommodation limitations have restricted somewhat the range of passenger-carrying coaches displayed, the rapid development of which dominates interest at the moment.

The programme of conferences that are being held at the exhibition included a discussion, which took place yesterday, by the Municipal Tramways and Transport Association on the subject of modern vehicle design, its relation to repair and maintenance, and power transmission on road passenger vehicles.

R. A. DYSON & Co., LTD., exhibit a unique vehicle in the form of a 110-ton transformer truck, which can be used as two separate 60-ton trailers if desired; it has been made for Messrs. Pickfords, Ltd. The flat platform has a loading height of only 3 ft. 6 in. and is supported on two bogies that can be operated from either end. The truck is provided with 32 wheels, shod with 64 solid rubber tires, and there are 8 axles (each 7 in. in diameter) and 8 brakes; the ball bearings of the wheels weigh 17 cwt. alone. Hand-operated steering gear is provided for the bogies, and the turning radius is only 24 ft. Each set of wheels tracks independently of the bodies, and every wheel is pivoted to conform with uneven road surface.

BEARDMORE MOTORS, LTD., amongst other vehicles, show a Chenard-Walcker tractor-trailer specially designed for the dual purpose of cable-drum transport and cable laying. They are made with a low-loading chassis and a carrying capacity of from 5 to 10 tons. A two-runway ramp is fitted for unloading the drums, which operation can be carried out by means of a hand winch mounted on the fore carriage of the trailer, or with the aid of a power-operated winch on the tractor. Two hinged upright members are provided for raising a drum and holding it in such a position that the cable can be unwound for laying without it being necessary to remove the drum from the trailer.

The BRISTOL TRAMWAYS & CARRIAGE Co., LTD., has a 6-wheel railless electric trolley 'bus chassis on view, weighing 4 tons 12 cwt. The wheelbase is 19 ft., and the track at the front is 6 ft. 1½ in. and 6 ft. 1⅜ in. at the rear; the wheels have pneumatic tires. The 500-volt motor is of 80 b.h.p.

The BRUSH ELECTRICAL ENGINEERING Co., LTD., has three 'bus bodies on view; a de luxe type single-deck body on a Leyland "Lion LT. 1" chassis; a top-covered enclosed staircase double-deck body on a Crossley 2-axle chassis; and a top-covered open staircase double-deck body on a Daimler 2-axle chassis. The last-mentioned seats 24 in the lower saloon and 28 on the upper deck, being 25 ft. 10 in. long, 7 ft. 5 in. wide, and 14 ft. 2 in. high; it was built to the registered design of the British Electrical Federation, Ltd.

The ENGLISH ELECTRIC Co., LTD., exhibits a double-deck trolley 'bus for seating 56 passengers in semi-bucket type seats with spring cushion backs. The Westinghouse air brake acts on all six wheels, each of which has a separate brake cylinder, and a hand brake operates separate shoes on all four rear wheels. The single 80-h.p., 500-volt interpole motor drives through three differentials to the back axles; gear ratio 7.75 to 1. The motor is controlled by a foot-operated series-parallel controller of the cam-operated type, with four series, three parallel, and one reduced-field notches; foot-operated electric braking is also provided. The company is also showing a trolley 'bus controller which makes use of air pressure to move the controller from notch to notch, thus reducing the pressure necessary on the foot pedal.

KARRIER MOTORS, LTD., exhibit a 60-seater railless electric trolley 'bus made for the Doncaster Corporation. It is of the 6-wheel double-deck type and driven by a 66-h.p. B.T.H. motor, being equipped with air brakes.

RANSOMES, SIMS & JEFFERIES, LTD., show a 6-wheel double-deck, trolley 'bus chassis fitted with an 80-b.h.p. motor constructed to the British standard specification for traction machines; it has two armatures in one casing, suitable for series-parallel control. Westinghouse air and hand brakes are provided on all wheels.

A feature of the vehicles displayed is the fact that, apart from the magneto ignition system, their electrical equipment for lighting by dynamo and engine-starting seems to be almost as complete and standard as that of private motor cars. Most of the well-known manufacturers of electrical accessories and garage equipment are exhibitors, including the following:—

Pirelli, Ltd., ignition and lighting cable.
Automotive Products Co., coil ignition outfits.
Tecalemit, Ltd., petrol pumps, clocks.

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Mann, Egerton, Ltd., garage equipment, battery truck, magnetic retrieving tool, &c.
Ripaults, Ltd., cable, batteries, sparking plugs.
Robert W. Coan, Ltd., aluminium lamp castings.
J. W. Pickavant & Co., Ltd., lighting and ignition accessories.
Simms Motor Units, Ltd., lighting and ignition components.
Bluemel Bros., Ltd., lamps, direction indicators.
Cooper, Webb-Jones & Co., lamps, bells.
British Thomson-Houston Co., Ltd., lighting and ignition accessories.
North & Sons, Ltd., magnetos.
Cooper-Stewart Engineering Co., Ltd., spotlights, direction indicators, windscreen wipers.
AC-Sphinx Sparking Plug Co., Ltd.
Hallam, Sleigh & Cheston, lamps, bells.
Miller Bros. (Brighouse), Ltd., light control and anti-dazzle devices.
Flexible Lamps, Ltd., "Rubbolite" unbreakable tail lamps.
K. L. G. Sparking Plugs, Ltd.
Ross, Courtney & Co., Ltd., "Facile" wiring terminal, tags.
R. D. Nicol & Co., Ltd., electrical advertising illuminated novelties.
C. A. Vandervell & Co., Ltd., general electrical accessories.
Joseph Lucas, Ltd., general electrical accessories.
Lodge Plugs, Ltd., sparking plugs.
M-L Magneto Syndicate, Ltd., ignition and engine-starting apparatus.
Batteries, Ltd, "Nife" nickel-cadmium-iron traction accumulators.
D.P. Battery Co., Ltd., "Kathanode" cells.
Scintilla, Ltd., general electrical accessories.
Pyrene Co., Ltd., "Moonbeam" non-dazzle lamps.
C. L. Jones, electrically-welded repairs.
Ward & Goldstone, Ltd., cables, foot warmers, fans, &c.
Thos. P. Headland, garage tools.
George Hatch, Ltd., garage tools.
Engineering & Equipment Co., Ltd., illuminated destination indicators, electro-magnetic crack detector.
F. J Gordon & Co., Ltd., "Hobart" battery chargers, electrical test bench, &c
Chloride Electrical Storage Co., Ltd., "Exide" batteries.
Tungstone Accumulator Co., Ltd.
Delco-Remy & Hyatt, Ltd., horns, lighting, starting, and ignition equipment.
B.E.N. Patents, Ltd., garage tools.
Chas. Churchill & Co., Ltd., garage equipment.
Champion Sparking Plug Co., Ltd.
Oldham & Son, Ltd., storage batteries.
Timson Bros., lamps, horns, tools, &c.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Electricity Charges in Rural Areas.

On October 30th Major GLYN asked the Minister of Transport what was the average cost per point for lighting at which cottages of normal "council" type were supplied with electricity by authorised undertakers in the counties of Cumberland, Derbyshire, Northamptonshire, Essex, Hampshire, and Berkshire.

Mr. MORRISON said he was not able to give this information. So far as he was aware, there were only a few cases where electricity was supplied to small consumers at so much per lighting point. There were, however, a number of cases where the undertakers charged in accordance with a two-part tariff, related in some way to the lighting installation or lighting points.

The Testing of Electricity Meters.

On October 31st Mr. DAGGAR asked the Minister of Transport, whether he had received a communication from the Monmouthshire County Council with reference to a resolution passed by that authority dealing with the present state of the law with regard to the testing and certification of electricity meters, which it considered to be unsatisfactory; and whether he intended to introduce legislation requiring the certification and stamping of all electricity meters.

Brigadier-General WRIGHT asked the Minister whether it had been brought to his notice by any public authorities that the present state of the law with regard to the testing and certification of electricity meters was considered defective; and, if so, whether he proposed to introduce the necessary amending legislation.

Mr. MORRISON said that representations in regard to this matter had been made to him by certain public authorities, and the matter was under consideration.

Failures of Electricity Supply.

On November 1st Mr. DAY asked the Minister of Transport whether his attention had been drawn to the inconvenience to the public caused by the various failures of the electricity supply on several occasions in the district of the County of London during the last six months; and could he say whether it was intended to hold an inquiry.

Mr. MORRISON said he understood from reports in the Press that there had been certain temporary local failures of electricity. He thought that undertakers were fully alive to their statutory obligations as regarded continuity of supply, but allowance must be made for unavoidable accidents. As at present advised he did not intend to hold an inquiry.

The Battersea Power Station.

On November 5th Sir SAMUEL HOARE asked the Minister of Transport whether he could make a statement on the present position of the projected Battersea power station.

Mr. MORRISON said that the London Power Co. had been authorised to proceed with the construction of the first section of the station and was under obligation to take the best known precautions for the due consumption of smoke and to prevent, as far as was reasonably practicable, the evolution of oxides of sulphur. It had, for those purposes, been conducting experiments on the prevention of the evolution of oxides of sulphur. The present position was that an interim report of the Government chemists on these experiments had now been received and was under consideration. He was arranging for the publication of the report as soon as possible.

Forthcoming Expenditure by Railways.

On November 5th, in reply to a question by Mr. Romeril, the Minister of Transport gave a list of schemes of development which the railway companies proposed to carry out consequent upon the repeal of the Railway Passenger Duty. This included the following items:—

Great Western Railway Co.—Coal-shipping appliances at Roath Dock, Cardiff (estimated to cost £215,000); substitution of electric lighting in gas-lighted stock (£80,000).

London & North-Eastern Railway Co.—New cranes and warehouse at Royal Dock, Grimsby (£94,000); new cranes at Parkstone Quay (£65,000); substitution of electric lighting in gas-lighted stock (£56,000).

London Midland & Scottish Railway Co.—Additional mobile 6-ton cranes (£50,000); improved arrangements in connection with signalling (£407,149); substitution of electric light in gas-lighted stock (£208,840).

Southern Railway Co.—Electrification of lines between Coulsdon and Brighton, Redhill and Guildford, and Preston Park and Worthing (£2,100,000).

Underground and Overhead Transmission.

On November 6th Mr. MARJORIBANKS asked whether contracts had been made in pursuance of the Electricity (Supply) Act, 1926, for laying cables underground; if so, in what localities; and what was the estimated or contract price for such work per mile as compared with that of carrying such cables above ground.

Mr. MORRISON said that the Central Electricity Board informed him that it had entered into contracts for laying three experimental lengths—totalling about 12 route miles—of main transmission cables in the London area; that the estimated cost for double-circuit underground cables was £30,000 per mile in round figures, and for single-circuit underground cables £15,000 per mile; and that these amounts were from eight to ten times more than the cost of the erection of double-circuit and single-circuit overhead lines, respectively. It should be understood that those lengths were about to be laid as an experiment in areas where there were alternative means of supply.

Cost of Changing Frequency.

On November 6th Colonel HOWARD-BURY asked the Minister of Transport whether he could give the reasons why the Central Electricity Board had declined to bear the cost of changing the frequency in the system of supply at Chelmsford; and whether there was any prospect of that decision being altered.

Mr. MORRISON said he was informed by the Board that the reasons for which it had declined to bear the cost of changing the frequency of the Chelmsford undertaking were that the change was not essential to the Board's scheme, and that the benefits likely to accrue to the undertaking from the scheme were substantially in excess of the cost of the change-over. So far as he was aware, there was no prospect of the decision being altered.

The Electricity Board.

On November 8th Mr. KELLY asked the Minister of Transport if he would state which interests were consulted as to the appointment of the chairman and members of the Central Electricity Board, and the parties and interests who nominated men for the positions.

Mr. MORRISON said that before appointing the Central Electricity Board a large number of associations and individuals representative of the interests of local government, electricity, commerce and industry, transport, agriculture and labour were consulted. He could not, however, undertake to give a detailed list of those who were consulted in connection with this matter.

Compensation for Displaced Employés.

On November 6th Mr. KELLY asked the Minister of Transport if he would state the amount of compensation paid during 1928 to men and women who were displaced from employment or whose position was worsened by the operation of the

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Electricity Act, 1926; and the amount paid in the first six months of this year.

Mr. Morrison replied that, so far as he was aware, no claims for compensation under or in consequence of the Electricity Act, 1926, had arisen, apart from claims which might have been settled by agreement between the parties, as to which he had no information.

Legal.

Valve-Holder Patent Dispute.

In the Chancery Division on November 7th, Benjamin Electric, Ltd., and the Igranic Electric Co., Ltd., sought an injunction to restrain Messrs. Garnett, Whiteley & Co., Ltd., Liverpool, from infringing the plaintiffs' patents for improvements in wireless valve-holders.

Mr. Trevor Watson, for the plaintiffs, said the infringement complained of was the selling by the defendants of certain valve-holders. The defendants admitted the sale, but pleaded that the holders which they sold did not infringe the plaintiffs' patents, and that those patents were invalid. The two patents in question related to holders for valves used for rectification and amplification in wireless telegraphy and telephony, and the inventions aimed at the provision of valve-holders which would be shock absorbing and also ensure sufficient rigidity of electrical contact. He contended that there was sufficient inventive subject matter in these two patents to make them valid and they had not been anticipated by any previous invention. The sale of the plaintiffs' holders had been adversely affected during the last two years by the sale of the defendant company's holders.

Mr. James Swinburne, F.R.S., was called, and described the particulars in which the defendants' "Lotus" antiphonic valve-holder resembled the plaintiffs' invention.

On the following day the advantages of the plaintiffs' valve-holder were demonstrated and Mr. Swinburne, continuing his evidence, explained that the defendants' holder resembled the plaintiffs' holder in that it contained a cantilever spring arranged horizontally and it made connections to the four terminals of the valve.

Cross-examined by Mr. Moritz, K.C., for the defence, witness agreed that the microphonic trouble was known in 1923 and the solution was well known. He also agreed that there was nothing new in the idea of supporting a valve by spring conductors to avoid the transmission of vibrations, but the difference was the way in which it was done. What was new was the arrangement of the springs carrying current between the wire base of the holder.

Mr. Moritz asked if it was not common in all kinds of apparatus where there were supporting springs to lead in the current by the springs. Mr. Swinburne agreed, but he did not concur in the suggestion that the idea of using stops was obvious and old.

Mr. K. S. Fennell, sole representative of the Benjamin Electric Company, said that defendants commenced selling their holder in January, 1926, and the Benjamin Company's sales went down by fifty per cent. His firm was the first to sell anti-microphonic valve-holders and then others soon came on the market.

This closed the case for the plaintiffs.

Mr. Moritz, stating his main points for the defence, contended that mere combinations of ideas were not patentable unless there was some advantage which flowed from their combination. Simply to lump together springs and stops and the fact that the electricity flowed through the springs did not make a patentable combination. As to prior inventions, he contended that the Sterling holder was on sale in 1923.

Mr. H. A. Gill, patent expert, said that the practice of cushioning against shocks was a well established idea and the provision of stops to limit the movement was also well known.

Mr. Stafford Cripps suggested that the plaintiffs' holder was absolutely new in achieving the objects aimed at. Witness did not agree, and said that he considered that Taylor's holder achieved those objects. Sterling also came before this invention and Highfield and Ross came very near it.

The hearing was concluded on November 11th, when Mr. W. Ward Miller, who in 1923 was chief engineer of the Sterling Telephone & Electric Co., said he designed a wireless set exhibited by the company at the Wireless Exhibition in 1923 which contained the Sterling valve holder.

Mr. Moritz, K.C., summing up for the defence, said that in the case of a mere combination of certain parts it was necessary in order to get a patent to show that advantage flowed from the combination, otherwise there was no subject-matter for a patent; and that was the position in the Burndept holder. There was no protection in this country for something which was merely neat workmanship and design and did not partake of the character of a patentable invention, and he claimed that the Burndept holder was merely a neat and economical production. As to the Benjamin holder, he contended that it did not contain any subject-matter for a patent. Both the Sterling and Highfield inventions which proceeded it made perfectly good valve-holders. Counsel, in conclusion, admitted infringement, but contended that neither of the patents could be supported.

At the conclusion of the argument his Lordship intimated that he would take time to consider his judgment.

Agreements between the G.E.C. and Marconi's.

Mr. Justice Eve, in the Chancery Division, on November 6th, gave the judgment which he had reserved in the case of the General Electric Co., Ltd., against Marconi's Wireless Telegraph Co., Ltd., and also in the case of the same plaintiffs against Marconi's and the M.O. (Marconi-Osram) Valve Co., Ltd. Both cases related to two agreements, one between Marconi's and the G.E.C., and the other between these companies and the M.O. Valve Co.

The question raised was whether, as the G.E.C. said, the agreements were permanent, or whether, as Marconi's said, they either were for a definite term or had been determined. Marconi's and the G.E.C. formed the M.O. Co. to acquire from the G.E.C. a factory and equipment at Brook Green for the manufacture of radio valves, and Marconi's said that the obligations of the parties were co-terminous with the lease of the factory. The G.E.C. took an opposite view.

His Lordship, in the course of his judgment, asked if he could imply from the fact that a term of ten years was fixed for the lease an agreement either that the adventure was to be existent for that period and no longer—in which case it would have automatically come to an end when the lease expired—or alternatively, that any party might by reasonable notice put an end to it on or after the date when the lease ran out. He did not think he could. The agreement was indefinite and was unlimited as to time. Some term had necessarily to be fixed for the duration of the lease, but there was not a word in the document to indicate that any of the obligations undertaken by the contracting parties outside those embodied in the lease were to subsist only so long as the lease was running. The more he examined the document the less able did he feel to raise any implication that the parties contemplated their relationship as being in any way dependent upon the leasehold term. In his opinion it was not. The result was that the applicants were entitled to a declaration that the agreement was not determined on May 25th, 1929, and Marconi's had no power to determine it. The costs must be paid by Marconi's.

Correspondence.

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession.

Rationalisation and Labour.

Referring to Mr. H. C. Parsons's article in your issue of November 1st, I would suggest that there is not only labour to be considered, but also the staff. To anyone who is at all familiar with the large combines in this country it is a matter for general comment that the inefficient redundance of staff and general waste of time is enormously increased. The exact figures are of course impossible to obtain, but I would venture to suggest that the output per individual in these large concerns is very much less than in the smaller companies; it is without doubt the case that the supervising staff is enormously greater. So far as the writer's observation goes the object of these mergers is not so much to reduce cost as to reduce competition and keep up prices.

Take the railway companies: they have introduced certain economies, but only at the sacrifice of the convenience of the public. Trains run no faster, do not stop less often, are no more comfortable, are much more crowded, and are less punctual. I have never yet found members of the staff of these large concerns who are really happy in their work. In the first place, they have no security in the continuity of their jobs, and no one takes any interest in what they do unless they make a mistake.

I can well believe that in a protected country the large concerns are able to show not only considerable ecnomies, but also increased profits; but in a country like ours where nearly all manufactured articles are in competition with those of other countries, whose work-people have a lower standard of living, these mergers are unlikely to be successful because they are never watertight.

Anti-Rationalisation.

November 4th, 1929.

Meter Pivots.

The A.E.G. Electric Co., Ltd., in its letter published on October 25th, states that it is surprised that my article on "Meter Pivots" was appended to Mr. Carr's paper, instead of to Mr. Lawson's. The reason for this was that I had prepared notes for a contribution to the discussion of Mr. Carr's paper, but I was unable to speak owing to lack of time at the meeting. There was, however, quite a considerable discussion on rotor bearings at Mr. Carr's meeting, as the company will find from the report in the I.E.E. *Journal*. It is by no means clear that the lubrication of pivots is a good thing. Mr. Lawson says that "oil is liable to stiffen or even solidify in the course of time, and for this reason has always been looked upon with suspicion." He also refers to the experiments of Mr. Fichter, who found that oil lubrication has no useful effect in reducing friction, as the oil is squeezed out between the surfaces of contact. Mr. Lawson further states that "oil immersion extends the life of the jewel and reduces the effect of wear on the accuracy, but is subject to physical changes and cannot be trusted for sufficiently long periods."

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I have sometimes wondered if a meter bearing could be made on the lines of an ordinary ball bearing, with, say, four or five small balls. The experiment would be worth trying. Mr. Carr's and Mr. Lawson's papers certainly make it clear that research on rotor bearings is very desirable, and the sooner it is put in hand the better.

The Writer of the Article.

November 6th, 1929.

Small Hydro-Electric Schemes.

There is apparently some discrepancy in the figures given in Table II of Mr. M. I. William-Ellis's article in your issue of October 25th. The capital cost of two 40-h.p. hydro-electric sets is stated to be £4,325; this gives an average cost of £54 per h.p., an abnormally high figure. The consumption is further stated to be 200,000 units per annum; on a 20 per cent. annual load factor, quite a normal figure for this type of plant, the maximum load would therefore be 114 h.p. As the total prime mover plant is only 80 h.p. the additional margin for peak loads apparently must have been obtained from a battery. Will Mr. Ellis kindly state whether this particular installation includes a battery, and if so, what amount is included for it in the total capital cost, *viz.*, £4,325?

Mr. Ellis's figures in Table I, representing the annual operating costs of the gas engine installation that was displaced by the hydro-electric plant, seem to me to be very much on the high side.

Interested.

October 28th, 1929.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1928.

11,252. "Synchronising devices for television and like systems." J. L. Baird and Television, Ltd. April 16th, 1928. (Cognate applications, 12,171/28, 14,185/28 and 15,578/28.) (320,639.)

11,257. "Devices for the commutation in transformers of electric alternate currents into direct currents and *vice versa*." M. Urbinati. April 26th, 1927. (289,401.)

11,589. "Sound recording and reproducing." C. F. Elwell and De Forest Phonofilms, Ltd. April 19th, 1928. (320,653.)

11,785. "Loud-speakers for wireless apparatus or the like." G. R. Searle. April 21st, 1928. (320,654.)

12,025. "Systems for the electrical transmission of synchronous movement." A. Blondel. April 27th, 1927. (289,439.)

14,273. "Control means for electric motor-driven devices." Cutler-Hammer Manufacturing Co. December 23rd, 1927. (302,682.)

17,416. "Electric batteries." Schmid-Patent Corporation. July 2nd, 1927 (293,299.)

17,454. "Method of and apparatus for starting and controlling electric motors." Brookhirst Switchgear, Ltd., and J. A. Hirst. June 16th, 1928. (Cognate application, 19,466/28.) (320,615.)

17,482. "Dynamo-electric machines." International General Electric Co., Inc. June 16th, 1927. (292,172.)

17,585. "Construction of stators of dynamo-electric machines." British Thomson-Houston Co., Ltd. June 20th, 1927. (292,509.)

19,919. "Automatic telephone system." L. Adam. July 9th, 1928. (320,605.)

20,415. "Film-driving mechanism for sound recording or reproducing apparatus." British Thomson-Houston Co., Ltd. August 11th, 1927. (295,378.)

20,581. "Automatic control of electrical apparatus." General Electric Co., Ltd., A. E. Angold and F. Barrell. July 16th, 1928. (320,634.)

20,614. "Electric cut-outs." W. T. Henley's Telegraph Works Co., Ltd., and W. H. Nichols. July 16th, 1928. (Cognate application, 11,471/29.) (320,622.)

20,621. "Emergency supply arrangements for working plants supplied with electric energy." E. Gerard. July 16th, 1928. (320,624.)

20,803. "Moving-coil loud-speakers." F. W. Lanchester. July 18th, 1928. (320,647.)

20,891. "High-frequency feeders and the like for use with radio aerial systems." C. S. Franklin. July 18th, 1928. (320,652.)

20,961. "Apparatus for the electrical reproduction of gramophone or like records." G. D. Powell. July 19th, 1928. (320,662.)

20,993. "Antenna." Trico Products Corporation. July 27th, 1927. (294,606.)

21,090. "Optical system for radio kinematographic transmitting and receiving apparatus." L. Thurm. July 21st, 1927. (294,257.)

21,098. "Motor-vehicle electric headlights." J. Lucas, Ltd., and O. Lucas. July 20th, 1928. (320,670.)

21,108. "Systems for the electrical transmission and reception of pictures, diagrams, or other representations." O. Fulton. July 20th, 1928. (320,671.)

21,117. "Process for the control of electric current impulses for the purpose of remote picture transmission or of television or the like." O. Fulton. July 20th, 1928. (320,673.)

21,129. "Vibration-damping devices." W. E. Beatty (Bell Telephone Laboratories, Inc.). July 20th, 1928. (320,676.)

21,230. "Glare-free headlamps for motor-cars, lorries, and similar vehicles." S. P. Holloway. April 6th, 1929. (320,693.)

21,706. "Electric boiling-plates and the like." Hotpoint Electric Appliance Co., Ltd., and W. J. Sims. July 26th, 1928. (320,700.)

21,863. "Apparatus for indicating the direction of a travel of a train." Siemens & Halske Akt. Ges. July 28th, 1927. (294,659.)

22,679. "Means for controlling apparatus at a distance." H. F. Joel, Jun. August 4th, 1928. (320,605.)

22,700. "Telephone exchange systems." Relay Automatic Telephone Co., Ltd., and B. B. Johnson. August 4th, 1928. (320,706.)

23,142. "Electric circuit controls for electrically-operated liquid-fuel burning apparatus." W. W Triggs (Williams Oil-O-Matic Heating Corporation). August 10th, 1928. (320,711.)

23,154. "Electrical vibratory devices such as loud-speakers." M. Trouton. August 10th, 1928. (320,713.)

24,819. "Reproduction of sound." W. E. Beatty (Bell Telephone Laboratories, Inc.). August 29th, 1928. (320,723.)

26,253. "Aircraft lamps." A. L Davis. September 13th, 1928. (320 730)

26,697. "Starting switch for automobiles." J. D. Sutherland. June 13th, 1928. (313,511.)

27,172. "Lighthouses for nautical and aerial purposes." R. Francotte. November 25th, 1927. (301,063.)

29,005. "Electric switch-operating devices." International General Electric Co., Inc. October 15th, 1927. (298,897.)

29,029. "Spark-plug testing devices." W. H. Strauss. October 9th, 1928. (320,757.)

29,771. "Electric switches." Dr. A. Scherbius and E. R. Ritter (trading as Scherbius & Ritter). October 21st, 1927. (Addition to 276,641.) (299,047.)

31,855. "Electric discharge tubes." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). November 1st, 1928. (320,783.)

31,919. "Electric heating units for cooking and like purposes." British Brass Fittings, Ltd., and A. Logan. November 2nd, 1928. (320,784.)

32,005. "Keying systems for use in radio or line telegrapny." Marconi's Wireless Telegraph Co., Ltd. November 2nd, 1927. (299,656.)

32,268. "Means for automatically breaking the circuit of the accumulators on automobile vehicles." Tecalemit, Ltd. November 5th, 1927. (300,139.)

32,452. "Electrical plug-and-socket couplings." J. A. Crabtree. November 7th, 1928. (320,793.)

32,632. "Apparatus for measuring ultra-violet radiations." A. K. Croad (Hanovia Chemical & Manufacturing Co.). November 8th, 1928. (320,794.)

35,572. "Signal horns." A. J. Stephens. December 3rd, 1927. (301,740.)

36,446. "Circuit arrangements suitable for use in signalling systems." Marconi's Wireless Telegraph Co., Ltd. December 10th, 1927. (302,180.)

36,975. "Electric insulators with screens of porcelain or the like non-conducting material." Akt. Ges. Brown, Boveri et Cie. May 9th, 1928. (311,314.)

36,976. "Electric insulators." Akt. Ges. Brown, Boveri et Cie. April 20th, 1928. (310,021.)

37,702. "Synchronous inductor frequency changers." British Thomson-Houston Co., Ltd. December 24th, 1927. (303,011.)

38,100. "Electrochemical processes." E. Citovich. December 24th, 1927. (303,027.)

38,396. "Electric switch, more particularly for automatically-operated switchgear." Landis & Gyr Soc. Anon. March 1st, 1928. (Addition to 185,426.) (307,009.)

38,410. "Circuit arrangements suitable for use in thermionic valve transmitters." Telefunken Ges. für Drahtlose Telegraphie. December 31st, 1927. (303,367.)

38,482. "Electrolytic preparation or purification of metals." L. St. C. Broughall. December 31st, 1928. (320,818.)

1929.

276. "Multiple-filament electric incandescent lamps." R. P. A. Andersson. January 3rd, 1929. (Addition to 315,638.) (320,822.)

458. "Step switch for regulating the voltage of transformers under load." Maschinenfabrik Oerlikon. January 17th, 1928. (304,232.)

926. "Electric ignition switch indicators for motor vehicles." F. G. McDonald. January 10th, 1929. (320,825.)

2,474. "Method of, and apparatus for recording by means of cathode rays, rapidly occurring phenomena." Vereinigte Gluhlampen und Elektricitäts Akt. Ges. February 1st, 1928. (305,168.)

2,507. "High-frequency electric signalling systems." British Thomson-Houston Co., Ltd. January 24th, 1928. (304,700.)

2,530. "Driving devices for 'pilgrim step' motion rolling trains." Siemens-Schuckertwerke Akt. Ges. January 25th, 1928. (304,734.)

2,999. "Feeding devices for the carbons of arc lamps." Anciens Etablissements Barbier, Benor & Turenne Soc. Anon. November 9th, 1928. (320,832.)

4,049. "Radio and the like receiving systems." Telefunken Ges. für Drahtlose Telegraphie. February 13th, 1928. (305,987.)

4,519. "Sparking plugs." H. Kopf. February 11th, 1929. (Addition to 285,268.) (320,834.)

5,145. "Electrolytic manufacture of iron." E. Kelsen. February 16th, 1928. (306,151.)

5,173. "Television apparatus and the like." J. L. Baird and Television, Ltd. April 16th, 1928. (Cognate application, 15,326/28.) (Divided application on 320,639.) (320,627.)

5,174. "Speed-controlling means for television and like apparatus." J. L. Baird and Television, Ltd. April 10th, 1928. (Divided application on 320,639.) (320,628.)

12,035. "Apparatus for the production and reception of electric signals, including television apparatus and the like." J. L. Baird and Television, Ltd. June 20th, 1928. (Divided application on 319,304.) (320,687.)

14,206. "Mercury electric switches." Dr. P. Meyer Akt. Ges. May 7th, 1928. (311,242.)

20,418. "Manufacture and production of magnetic cores of high permeability." J. Y. Johnson (I. G. Farbenindustrie Akt. Ges.). July 14th, 1928. (Divided application on 319,854.) (320,611.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from November 6th:—

Electrac. No. 499,883. Class 6. Toothed gearing, being parts of machines for use in connection with electric railways and tramways.—Moss Gear Co., Ltd., Chester Road, Tyburn, Birmingham.

Siloluxe. No. 505,144. Class 6. Electric vacuum cleaning machines.—C.C.A. (Vacuum Cleaners), Ltd., 324, Gray's Inn Road, W.C.1.

Governor. No. 503,919. Class 8. Electric accumulators and batteries (not for medical purposes), electric measuring instruments, &c.—John Shaw and Sons, Ltd., Wolverhampton.

Koh-i-Noor. No. 505,325. All goods in Class 8.—Hunter, Penrose, Ltd., 109, Farringdon Road, E.C.1.

Novotone. No. 505,4488. Class 8. Instruments and apparatus for radio signalling, sound reproducers, and thermionic amplifiers, &c.—Gambrell Bros., 307, Merton Road, Southfields, S.W.18.

Gnome. No. 506,062. Class 8. Radio receiving sets and loud-speakers.—Rees Mace Manufacturing Co., Ltd., 39a, Welbeck Street, W.1.

OK, Made in Germany (lettering and design). No. 506,244. Class 8. Electric batteries (not for medical purposes).—J. Toubkin, 33, Long Millgate, Manchester

Barkrole. No. 506,246. All goods in Class 8.—John Barker & Co., Ltd., 83, Kensington High Street, W.8.

Burco, The Finest in the World (lettering and design). No. 503,503. Class 13. Electric urns and wash boilers.—Burnley Components, Ltd., Accrington Road, Burnley.

Invercone. No. 506,145; and Horolux. No. 506,146. Class 13. Electric light shades and reflectors.—Benjamin Electric, Ltd., Tariff Road, Tottenham, N.17.

Restlight. No. 505,109. Class 15. Glass screens for use in shading electric light.—Restlight, Ltd., Aldwych House, W.C.2.

Alpha. No. 502,004. Class 18. Electric radiators and electric heating stoves.—Wright, Bindley & Gell, Ltd., Penistone Road, Sheffield.

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New Work for Contractors

Particulars of new works and building schemes for the use of electrieal installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

BEDWORTH.—School (500 places), for the Warwickshire E.C.; L. E. Stephens, clerk, Leamington.
BEXHILL.—Houses; E. E. Matthews, J. Hunt, and S. D. Hicks, all of Collington Avenue.
BILLINGHAM.—Bank, for Barclay's Bank, Ltd. Municipal Offices (£12,700), for the U.D.C.; surveyor.
BLACKBURN.—Housing scheme (194), Whitebirk Road district; H. M. Webb, borough engineer. School at Intack (400 places); director of education.
BRADFORD.—School chapel at Crossgates, for Rev. Fr. O'Halloran (£11,000); Empsall, Clarkson & Clarke, architects, Piece Hall Chambers.
BRISTOL.—Market, Philadelphia Street (£250,000); city engineer.
BURNLEY.—Housing scheme (176); borough surveyor.
CANNOCK.—Schools and extensions (£45,000), for the E.C.; W. E. Swift, secretary.
CHEADLE.—School (400 places), for the Cheshire E.C.; R. Potts, clerk, Chester.
CHELMSFORD.—Additional 130 houses, for the T.C.; borough surveyor.
COLNE.—Housing scheme (76), Harrison Drive; borough surveyor.
DAGENHAM (Essex).—Shops (10), Coresbrook Road, for E. Meredith. Shops (8), Oxlow Lane, for H. A. Odell.
DARTFORD.—Boys' and girls' central schools, for the Kent C.C. (£39,989); F. Ling & Sons, Erith, contractors.
DEAL.—Houses (42), for Snowdown and Bettshanger Tenants, Ltd.; secretary.
DINGWALL.—Academy (£40,000), for Ross and Cromarty E.C.; director of education.
DORKING.—School (£40,755), for the Surrey E.C.; A. Monk, builder.
DUDLEY.—Houses (500), Priory estate; borough engineer.
EDINBURGH.—Reconstruction of Huntly House as museum; E. J. MacRae; city architect. Factory at Hayfield, Gorgie Road; Peter McConnell.
ELGIN.—Additional 48 houses, for the T.C.; burgh surveyor.
GUISELEY.—Housing scheme (48), Carlton Manor estate; surveyor to U.D.C.
HALIFAX.—Factory, Clare Road; W. Hall, architect, 10, Commercial Street.
HAMILTON.—Roller skating rink; E. H. Bostock & Sons.
HEREFORD.—Extensions, General Hospital (£30,000); William Bowers & Co., builders
HERTS.—Schools and extensions, for the county E.C.
ILKESTON.—Houses (64), Northern estate; borough engineer.
IRISH FREE STATE (Limerick).—Electric lighting installation at Mental Hospital, for the Committee of Management; J. O. O'Malley, Mental Hospital. Mechanical filtration works (£12,000); borough surveyor.
(Borrisokane, Co. Tipperary).—Erection of David Clarke Memorial Hall; T. J. Cullen, architect, 25, Suffolk Street, Dublin (returnable deposit of £2 2s.).
KENDAL.—Extensions to Westmorland County Hospital; J. F. Curwen & Sons, Highgate, Kendal.
KENILWORTH.—School (500 places), for Warwickshire E.C.; L. E. Stephens, clerk, Leamington.
LEEDS.—Shops and offices, Guildford Street (£95,956); J. T. Wright & Sons. Cinema, shops, &c., Wellington Road, New Wortley; West Leeds Amusements, Ltd.
LONDON (West Ham, E.).—Extensions, Children's Sanatorium, Langdon Hill, for the T.C.; borough engineer (returnable deposit of £1).
(Barking, E.).—Additional 100 houses, Upney estate, for the U.D.C.; surveyor.
(Bermondsey, S.E.).—Reconstruction, Vaughan Street area (£57,000); borough engineer.
(Beckenham, S.E.).—Cinema (£55,000), High Street; W. J. Watt, builder, Bromley Road, S.E.
(Catford, S.E.).—Houses (72), Daneby Road and Crantock Road; A. E. Thomas.
(Greenwich, S.E.).—Billiard hall, Westcombe Park Road; P. B. Dannatt.
(Eltham, S.E.).—School (£29,914); W. H. Gaze & Son, Ltd., builders, Kingston-on-Thames.
LYDNEY.—Housing scheme (53), for the R.D.C.; surveyor.
MORDEN.—Houses, St. Helier estate; G. T. Crouch (24-acre site), H. W. Selley (17-acre site).
NEWARK.—Technical college (£23,475); Greenwoods (Mansfield), Ltd.
NOTTINGHAM.—Schools (2,760 places), Aspley estate; city engineer.
OSSETT.—Extensions, Moorcroft Mills; Hepworth & Bros., Ltd. Alterations, mills, Church Street; Rhodes and Halmshaw.
OSWALDTWISTLE.—Senior school; director of education, County Education Offices, Preston.
PLYMOUTH.—Additions, Grand Hotel, Hoe; Grand Hotel Co. New block, Mount Gold Hospital; borough architect. Factory, Oakfield Terrace; Clark, Doble & Co., Ltd.
POLESWORTH.—School (300 places), for Warwickshire E.C.; L. E. Stephens, clerk, Leamington.
PONTEFRACT.—Extensions to smallpox hospital at Sherburn, for the Joint Hospital Committee (£10,000); Tennant & Smith, Ropergate.
POULTON.—Senior school; director of education, County Education Offices, Preston.
PRESTON.—County offices (£130,000); county architect, 16, Ribblesdale Place. Motor-'bus garage, "Dick Howe," Ambleside, for Ribble Motors Service, Ltd.; C. D. Quinn, head office, Frenchwood Avenue.
QUARRY BANK.—Two senior schools, for Staffs. E.C.; director of education, Stafford.
REDDITCH.—Secondary school (£29,000); H. W. Simister, architect, Birmingham.
RICKMANSWORTH.—School, for the Merchant Taylors' Company, Charterhouse Square, London; secretary.
ROTHERHAM.—Elementary school, Herringthorpe estate; enlargement of South Grove and Kimberley Road central schools; borough engineer.
ROWLEY REGIS.—School (480 places), Church Farm estate, for the E.C.; director of education.
RUGBY.—Two schools (1,000 places), for Warwickshire E.C.; L. E. Stephens, clerk, Leamington.
ST. ALBANS.—Enlargement of Hill End Mental Hospital (£196,500); J. M. Sheppard, architect for Hertfordshire C.C.
ST. HELENS.—School (1,000 places), Parr, for the borough E.C.; W. H. Andrew, clerk.
SCUNTHORPE.—Public baths, for the U.D.C. (£18,000).
SHEFFIELD.—Conversion of printing works to technical institute; city architect.
STOCKPORT.—Boys' secondary school, for the borough E.C.; director of education.
STOCKTON-ON-TEES.—Extensions, Portrack Schools, for the borough E.C.; G. P. Stainsby, architect, 25, High Street (returnable deposit of £1 1s.).
STONEHAVEN.—Waterworks scheme (£20,000); borough surveyor.
STRETFORD.—Houses (55), Northleigh Road; W. R. Rochell. Flats and garages, Chester Road; Cotton Storage Co., Ltd. Hall, library and wash-house, Trafford Park (£10,500); U.D.C. surveyor.
TODMORDEN.—Re-erection of the Premier Cabinet Works, Halifax Road, for James Henry Sutcliffe & Son (£25,000).
TONBRIDGE.—Hospital (£14,000), for Queen Victoria Cottage Hospital Committee; H. A. L. Rudd, hon. secretary.
TUNBRIDGE WELLS.—Senior boys' school (480 places), for the borough E.C.; director of education.
WALSALL.—Additional 1,000 houses, for the T.C.; borough surveyor.
WOKING.—Re-erection of portion of works, for Accumulators of Woking, Ltd.
WOLVERHAMPTON.—Additional 200 houses, for the T.C.; borough surveyor.
WORCESTER.—Aerodrome; city engineer.
YORK.—Houses (100), Burton Stone Lane estate; F. W. Spurr, city engineer, Guildhall (deposit £2 2s.). Houses (111), Tang Hall estate; John Sawdon, Bridlington. Hall, Tang Hall estate; Rev. H. Horrox. Houses (56), Burton Lane estate; O. Weaver, Mexborough. Development, Muncaster estate; Denby Collins.

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The ELECTRICAL REVIEW

FOUNDED 1872

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The

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Effects of the Wall Street Crisis.

MORE than twenty years ago—twenty-two to be precise—a financial panic in America was the cause of depression throughout the world. Many things appearing to have but the remotest touch with our everyday financial system came to a standstill. Indeed, as we well remember, a brake was put upon enterprise practically everywhere. To-day, when everything has grown to vaster proportions, a somewhat similar state of things has arisen in New York, and observers, whatever their nationality, are beginning to ask: what will be the outcome? Happily we have the assurance of authorities that the results of 1907 cannot be repeated now, thanks to the reform of the American banking system in the intervening years. There has been no other panic of similar description until now, for the financial situation due to the European war comes within a different category.

After the trouble of 1907 had spent itself, anxious observers scanned the horizon with feelings of mingled hope and anxiety for signs of movement in countries far and near, and at last, first hesitating and vague, then more reliable and definite, came indications that confidence was returning—things were moving satisfactorily toward revival. We recorded the nature of the indications in some detail in the ELECTRICAL REVIEW at the time. One of the first signs was the indication of a greater disposition to set afoot business inquiries in distant lands, as shown by the increased receipts of the submarine cable companies. Gradually there followed renewed activity of State and other public departments which had held up development works for a time, and contracts began to flow in to accelerate the rate of revolution of the wheels of industry here and elsewhere.

It was the re-establishment of confidence that was such a difficulty in the process of revival. Can we do anything to-day to prevent loss of confidence resulting in 1929? While it would be useless to hazard prophecy, we feel that unless the situation worsens there is hope to be found in the mere fact of things not being

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exactly as they were on the former occasion, but there are some interesting phases of the question which it will be well to watch.

The first effect of the great losses that have been incurred must necessarily be felt in the United States, and as prices may not at the time of writing have reached their lowest, no kind of estimate of the extent of that effect is worth while. When, however, the public, or any large section of it, finds itself so much poorer that it must cut down its purchases, or cease saving and investing, one is naturally led to suppose that there may follow adverse industrial and trading conditions. Already it is reported that motor-car, radio, and other industries are feeling the draught. We all know, however, that the wealth of the United States for some years past, due to various causes, has been fabulous. While that fact may, to some extent, have reduced the force of the blow, it has also been an incentive to extravagant speculation and luxurious spending. This has led to industrial and trading operations of immense proportions—mass production with large available stocks, and so forth. If, however, well-filled stores are not emptied by home demand, the goods must be got rid of in some other way, production must be slowed down and world prices may be affected, upsetting our own and other markets. It is being pointed out that the conditions which have arisen on Wall Street will subject the vast hire-purchase and credit system of the United States, which has grown so rapidly during the past decade, to the severest test that it has ever had. It has been unquestionably responsible for a large share of American prosperity in electrical, motor-car, vacuum cleaner, and other trades. Losers directly affected by the recent slumps, and those indirectly affected by the consequences thereof, may not find it easy to meet their hire-purchase obligations, but, on the other hand, necessity may drive other people to avail themselves of a system which in their prosperity they did not use. It will be remembered that advocates of the system in this country have always quoted a very low percentage loss based on past U.S. practical experience, but those who have been in the habit of regarding hire-purchase in a conservative way will not be slow to quote present American experiences, with a possible change of habit, however temporary, in support of their attitude.

So far as concerns the benefit that the credit payment system may bring to the consumer's branch of the British electrical trade in the future, we are inclined to be optimistic, providing that the system is applied with proper caution and that traders and authorities have adequate financial backing. But it will be profitable to watch its operation in the States during this period of stress.

Among the consequences of Wall Street operations, as Stock Exchange writers and others have been stating, has been the lowering of certain British electricity supply and other electrical shares due to the withdrawal of American buying, and it may be that there will be a temporary slackening of the use of American capital in Europe.

The G.I.P. Railway.

The electrification of the main lines of the Great Indian Peninsula Railway, which is described in this issue, is the second important scheme of the kind to be inaugurated within the British Empire. The first was the Pietermaritzburg-Glencoe section of the South African Railways (Electrical Review, April 15th, 1928) with which it is comparable in magnitude, though possessing many dissimilar features.

Among the advantages expected in India from the change-over from steam are: a considerable reduction in journey time, purer atmosphere in tunnels, a reduction in strain on bridges and in wear and tear of the track, and abolition of the danger of fire to sleepers and neighbouring crops. These advantages are common, to a greater or less degree, to all similar schemes, and will no doubt be properly considered by the present Weir Committee on railway electrification. It is, as experience in the application of electricity to industry has shown, very difficult to set an economic value on such incidental advantages. Experience has, however, undoubtedly proved them to have in general a far higher value than was originally suspected.

Another point having a bearing on the position in this country is that, with the exception of the mechanical parts of 10 out of 65 locomotives, the work was the product of British factories to meet conditions more severe than are experienced in Great Britain.

The Relief of Unemployment.

On a later page we give publicity to the views of the Electricity Commissioners as to the manner in which the electricity supply industry can best assist in solving the unemployment problem. Their suggestions may be summarised as follows—to lay mains in advance of demand, to increase the capacity of distribution systems to meet the larger domestic demand to be expected in the near future, and to develop hire and hire-purchase schemes. The Commissioners also point out the advantage of an early change-over from d.c. to a.c. distribution, having in view the fact that before long most undertakings will receive an a.c. bulk supply from the Grid. As the carrying out of these recommendations will require but a slight intensification of the activity that characterises most progressive undertakings, it is reasonable to suppose that their fulfilment will not prove too onerous in the large majority of cases.

Christmas Trade.

Electrical contractors and retailers are, we hope, well prepared with their arrangements for doing a bumper trade in electrical appliances and contrivances for Christmas and New Year gifts. A large collection of goods suitable for this purpose has been brought before our readers in various domestic and other articles, and in our advertisement pages recently, so that it is not necessary for us to detail them again. What we wish to do more particularly this week is to direct attention to the efforts of the British Electrical Development Association, whose staff has prepared a special series of Christmas window displays. Some reference to them appears in our "Business Notes" pages to-day and we recommend electrical firms and undertakings having showrooms to secure from E.D.A. at once, if they have not already done so, copies of its Monthly Sales and Publicity Programme for December, in which they will find particulars of various Christmas publications and pictures of window dressing aids.

Circuit Breakers Without Oil.

Several attempts have been made during the past few years to develop a circuit breaker of high rupturing capacity without the use of oil. The paper read by Messrs. Wedmore, Whitney and Bruce before the Institution of Electrical Engineers last session (Electrical Review, December 28th, 1928, p. 1132) opens up a wide field of enquiry, provided the necessary funds are available to the E.R.A., and we look forward to the further details then promised us when the patent situation permits. Successful tests were claimed in the U.S.A. for a vacuum circuit breaker, but later information is lacking. A more recent invention, the "Deion" circuit breaker, was described in the Electrical Review of March 29th.

In this number we give an account of a French proposal to substitute gas under pressure for oil. This is based upon the fact that the superiority of oil in dielectric rigidity, heat capacity, and conductability at atmospheric pressure does not apply at higher pressures. One of the advantages claimed is the elimination of the danger of fire or explosion due to the large quantities of oil required in a heavy-duty iron-clad switch. We think, however, that such a fear is far less prevalent than it was; this view is supported by the steady spread of the iron-clad switch from this the country of its origin to other lands.

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The Refrigeration of Electrical Apparatus.

A consideration of the possibility of using pressure gas instead of oil for transformers and switchgear, based on a report by Mr. Neu* presented at a conference at Nantes, France.

IT can be said without much hesitation that some of the most important problems regarding the development of bulk electricity supply lie in the direction of the limitation of the cost of transforming and control apparatus, with which the question of cooling is closely associated.

The French Professional Association of Producers and Distributors of Power (the Syndicat Professionnel des Producteurs et Distributeurs d'Energie Electrique) of Paris, an undertaking that carries out somewhat similar functions for power companies to those that the I.M.E.A. carries out in our country for municipal undertakings, had these questions before it when Mr. Neu read a paper on the use of refrigerating machinery and high-pressure gas to increase the security of operation of power station and sub-station apparatus.

Mr. Neu points to the paradox that when converting heat into energy one tries to avoid the loss of heat, whereas when one wishes to convert electrical energy into motive power, or convert electrical energy into energy in another condition, one tries to get rid of the heat loss in the process as quickly as possible, as excessive temperatures lead to the limitation of usefulness in the way of output, and reduce the effective life of the apparatus used. In early days atmospheric air was used largely as a dielectric and cooling medium for all classes of electrical apparatus, but increases in capacity and voltages led in the abandonment of air in this double rôle, oil being used in transformers and switchgear and cooled forced draught air in generators and large motors.

If, instead, one has recourse to the low temperatures obtainable with industrial refrigerating plant, it is possible to increase the number of heat calories drawn off, and by lowering the temperature of the electrical material used, the capacity of any given plant can be increased and also security of operation. In Germany, with the aid of refrigeration, an increased output of a transformer of 40 per cent. has been obtained. The lowered temperature of the transformer windings brings about a lower resistance and watts are thus saved; there is no perceptible variation in iron losses; the energy required to run the refrigerating plant is practically balanced by the reduced C^2R losses.

With turbo-alternators, cooling is effected with filtered open or closed air circulation; in America, hydrogen with its superior cooling capacity is being used for such purposes, although such an arrangement is somewhat sensitive and dangerous. One can with advantage, however, cool the circulating air by means of refrigerators and thus increase the alternator output, make the insulation safer, and give greater capacities for overload.

A generating station having refrigerating plant could in summer, at times of lower loads, utilise it for the making of ice, or for the supply of refrigeration services to neighbouring undertakings.

For example, assuming a station with a peak output of 125,000 kVA with generators of the normal type, with circulating air cooled with water coils, and comparing it with one fitted with generators of an output under similar conditions of 100,000 kVA only, then, with the aid of refrigerating plant and extra cooling coils, the latter could give a peak of 125,000 kVA also; calculations show that the capital cost and power costs leave a good margin, especially as the number of hours on the peak per year would be limited. For this class of service steam operated refrigerating plant could be adopted with advantage, utilising the main or separate condensers; water cooling being utilised at low outputs; with steam turbines at very high pressures bled steam could be used for operating the refrigerating plant.

A refrigerating installation operated by steam which requires ejectors and centrifugal pumps only would not lead to sensible complications in a steam generating station.

With regard to transformers, the use of such plant would give comparable results. The transformer capital cost is about half that of an alternator, and the calories to be dissipated per kilowatt would also be about half, so the results would be of the same order, the overload capacity would exceed that of the normal type assumed, namely, 25 per cent.

It is customary to employ oil in high-voltage switches and in transformers; its use is not without serious difficulties and great dangers, oil being essentially combustible and easily inflammable; in large central stations one can measure the oil in hundreds of tons in service. Oil is hygroscopic, special precautions are necessary for its use in service, namely, filtration and drying; its purchase cost is very high; under excessive heating in a coil under oil, bituminous and carbonaceous deposits are formed which give rise to great trouble when repairs are necessary.

In switchgear, when a circuit is opened, oil give rise, by inertia to violent mechanical shocks, resulting sometimes in the bursting of tanks, explosions, and fires, the inertia hindering the rapidity of separation of the moving parts. Many accidents have taken place due to the use of oil; if oil is a useful auxiliary to the electrician it is costly, dangerous, and often objectionable, and the question is, can its use be avoided? The author of the report thinks it can be, as the superiority of oil over air at atmospheric pressure lies in the dielectric rigidity and the greater heat capacity and conductability of the former; this superiority is only present at atmospheric pressure, but it diminishes and becomes negative if the air pressure is sufficiently increased. The researches of Paschem, Cassuto, and Stauescu show that, other things being equal, the dielectric rigidity of gas is such that the explosive potential at a pressure of 6 to 7 kg. per sq. cm. (85 to 100 lb. per sq. in.) is about the same as that of the best quality of oil. The calorific conductability with both systems would be of about the same order. Its measurement is difficult enough with mobile liquids, it becomes more difficult still with a gas, although experience with heated compressed air and steam shows that the calorific conductability of a gas increases rapidly with pressure.

The author therefore puts forward the proposition of replacing the oil in transformers and switches by a gaseous atmosphere at a pressure of several kilogrammes per sq. in. (1 kg. sq. cm. = 14 lb. per sq. in.). That atmosphere would have about the same dielectric

* Contributed by Major Theodore Rich, A.M.I.E.E.

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and thermal properties as the oil, without its inconveniences. As gas one could consider air, nitrogen, and carbonic acid gas, the two latter having the advantage of not being carburants. Carbonic acid is a material widely used in commerce in the form of a liquid contained in steel gas bottles; it is used largely for the operation of (lager) beer services in restaurants. One could therefore consider the utilisation of such a system even for small isolated transformer stations, commercial carbonic acid bottles being attached to transformer tanks with automatic valves to make good any gas leakage that might take place. Trip gear might be included to operate on an excessive fall of gas pressure.

The transformer tanks could be built for a pressure of 8 kg. per sq. cm. (113 lb. per sq. in.) and arranged with external cooling coils; they would not be much more expensive than the tanks for oil with vertical oil circulation tubes, current on the market. The circulation of the compressed gas in these tubes would proceed much more easily than with oil, as the coefficient of expansion is so much greater, and its coefficient of friction so much less. This compressed gas could also be cooled with the aid of refrigerating plant.

With circuit breakers there would be no difficulty in the adoption of tanks capable of resisting a pressure of several kg. per sq. in. In a study of Messrs. Boliny and Bennugei made in March, 1927, the work of breaking a short-circuit on the network of the Main Paris Distribution Company, assuming six 15,000-kVA alternators in parallel, was taken as 1,340 kW, for a power of 279,000 kVA; assuming a tank of 150 litres of carbonic acid at 85 lb., the 1,340 kilojoules represents 320 calories, which would give an instantaneous increase of temperature of 640 deg. C., or a pressure of 19 kg. per sq. cm., or 270 lb. per sq. in.

It might be pointed out that the existence of pressure gas in a station would enable the servo-motor operation of switches to be carried out in a way much easier and simpler than with solenoids or electric motors.

The author, Mr. Neu, is of the opinion that :—

(1) Without material modification of the general installation of transformers or alternators, the oil or air circulation system can be energetically cooled with the aid of refrigerating plant, the security and overload capacity of the plant being thereby increased.

(2) In transformers oil could be replaced by gas under pressure cooled either by the usual cooling coils in atmospheric air, or by means of refrigerating plant.

(3) The replacement of oil switches by switches under gas pressure.

It would be of interest to study these questions which would increase output, and improve the operations of plant of large capacity at high pressures, and take away the sword of Damocles which actually hangs over the heads of producers and distributors of electricity who employ oil-immersed apparatus.

During the discussion which took place, the British type of enclosed switchgear was mentioned, but its merits were materially discounted by anxiety regarding the use of still further quantities of inflammable oil, the risks inherent in oil-filled apparatus being realised.

Slide-Rule Calculations.

A Method of Determining Efficiencies within Close Limits.

By L. J. VANN, A.M.I.E.E.

WHILST there are a number of engineers who employ the method of calculation detailed below, there appears to be a large number also who are not acquainted with it. It is hoped, therefore, that for the sake of the interest it may have for the latter, the former will forgive the publication of data already familiar to them.

The efficiency of a machine is generally defined as the quotient of output divided by input. The determination of this value by calculation tends to become laborious, whilst to obtain it directly on the slide-rule is tedious and unreliable, owing to the necessity of reading to four figures at the closer portion of the scale. In nearly every case the efficiency is known approximately, and the object of determining this quotient is to ascertain the third, fourth, and possibly fifth figures. Yet, whilst the first and second figures may be read without difficulty, to obtain a correct reading of the succeeding figures entails considerable care.

To overcome this difficulty, a method is suggested below which enables the efficiency to be determined by a slide-rule reading extending to two only or to three figures, these resulting generally at the coarser end of the scale. It is based on the circumstance that the efficiency tends towards unity in all cases, from which it follows that the difference between unity and efficiency is always a number commencing with noughts or very low figures. Thus, if the efficiency be 0.8865, by subtraction from unity we get 0.1135, which can be read many times more accurately, whilst for an efficiency of 0.9875 we get 0.0125, an even simpler reading.

It will be seen that if a simple connection can be traced between such a figure and a known value it can be determined by slide rule instead of the efficiency and the latter obtained from it by subtraction.

Now let "% total loss" = x
and "100 − % efficiency" = y

Then since "% efficiency" $= 100 \times 1/[1 + (x/100)]$

$$y = 100 - \{100 / [1 + (x/100)]\}$$
$$= (100 + x - 100) / (1 + [x/100])$$
$$= x / (1 + [x/100])$$
$$= 1 / ([1/x] + 1/100)$$

i.e., $y = 1 / ([1/x] + 0.01)$

and $100 - y =$ % efficiency.

Now whereas these formulæ appear less straightforward than that directly defining the efficiency, they can actually be determined with ease and accuracy. The method is as follows :—

Opposite "10" on the D scale bring x on the C scale; read D scale opposite "1" on C scale. Move C scale to the right to increase the reading by 0.01; read C scale opposite "10" on D scale. The resulting value gives y, which by subtraction from 100 gives the efficiency as a percentage.

It will be found that this method permits rapid calculation, as in many cases greater accuracy is possible than is actually necessary. This is exemplified by the case of a 5,000-kVA transformer having an iron loss of 14,000 watts and a full-load copper loss of 46,000 watts. Expressing these as percentages, and reading the corresponding percentages at fractional loads direct from the slide rule we get :—

Output.	Full load.	¾ load.	½ load.	¼ load.
%Iron loss ...	0.28	0.374	0.56	1.12
%Copper loss ...	0.92	0.69	0.46	0.23
x−%Total loss ...	1.20	1.064	1.02	1.35
Adjusting by slide rule as defined above we get :—				
y=	1.187	1.052	1.01	1.331
Whence by subtraction from 100 we obtain :—				
%Efficiency ...	98.813	98.948	98.99	98.669

For commercial purposes these figures may be contracted to :—

Approx. % Efficiency ...	98.81	98.95	98.99	98.67

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Wayleaves for Overhead Lines.

Some Notes Arising from Experience in Negotiating Wayleaves for Lines Over Private Property.

By W. A. ROBINSON, A.M.I.E.E.

THE obtaining of wayleaves may, at first sight, appear to be simple, but, in many cases, infinite tact and patience are required in dealing with difficult and often ignorant land owners. Without the exercise of these essential qualities, the engineer will have great difficulty in obtaining the necessary permissions for the erection of a projected overhead line. It must always be remembered that, in making an application for a wayleave, a favour is being asked, and landowners must, accordingly, be treated with appropriate respect. As a general rule, the poorer the education of the owner, the more difficult is the engineer's task.

Speaking broadly, owners and tenants may be divided into three classes:

(1) Those who readily agree to the scheme.
(2) Those who do not agree, but are open to persuasion.
(3) Those who definitely refuse.

It is not necessary to deal further with those owners who fall in class (1) beyond mentioning that their agreement may be due to a genuine desire to be helpful in pushing forward rural electrification, or it may be due to the realisation that the ultimate construction of the line is inevitable, or, more frequently, they want electricity themselves.

In dealing with owners who belong to class (2) the object of the engineer should be to ascertain as soon as possible exactly the point of view of the man he is interviewing with regard to the projected line. The objections that are raised by different people are very numerous. Generally, it is the inconvenience of having the poles in a field which is mentioned, but often it is their unsightliness, and sometimes it is the danger of the live wires. In any case, having found out what the real objection is, the engineer can usually break down the resistance of the owner by pointing out that the objection cannot logically be sustained in view of the advantages to be gained in the country from the manifold uses of electricity. The writer has frequently come across a farmer who will consent to the erection of poles on his land, provided the line also crosses the fields of his neighbour, with whom, perhaps, he has quarrelled. This point of view can, as a rule, be overcome by mentioning that the farmer cannot reasonably expect the line to be diverted so that he may pay off an old score upon his neighbour.

It often happens that an owner will readily agree to the erection of a line on his land if it runs along the hedges and does not traverse his fields. This objection can generally be met by pointing out that, for the sake of strength and efficiency, it is essential for the line to be as straight as possible; moreover, the fewer the angles there are, the fewer will be the number of stays necessary. Another point which may be raised is that it is to the owner's interest to render the construction of the line as economical as possible, so that the price of electricity may be reduced to a minimum. The plea that the presence of the poles and stays in a field is a source of danger to stock may be dealt with by the engineer agreeing to adopt any measures in the way of guarding which the farmer may consider desirable. In addition to the above considerations, the engineer may sometimes gain a point by asserting that electricity is badly needed in the neighbourhood, mentioning names if possible, and suggesting that the farmer himself may at some future date be glad to avail himself of it.

When approaching an owner belonging to class (3) the best course for the engineer to pursue will be to request him to state frankly and precisely why he refuses to give his permission. In most cases he will be unable to make any definite statement beyond saying that he is not going to have his land depreciated in value by the presence of poles, or that it must be quite easy to divert the line so that it does not touch his property. In any case, he refuses to give his consent to the erection of the line.

In general, it will be found best to leave the class (3) owner at this point, and proceed to obtain written consents from the other owners and tenants along the proposed route. When this has been accomplished, the recalcitrant owner can again be approached and told that all the other permissions have been granted, and that the scheme cannot be abandoned because one owner refuses to give his consent. A strong point is to mention that you have been informed in the neighbourhood that he is a public-spirited man and that he would be the last man to stand in the way of progress, or do anything to prevent the benefits of a supply of electricity being brought to the district. Again, it may be said that electricity is being made available for villages all over the country, and that surely he is not going to be the man to deprive his own locality of advantages enjoyed by other districts.

If all these arguments fail to produce the desired result, a stronger line may be taken by explaining that the neighbourhood has asked for a supply of electricity, and you are bound by Statute to provide it. You have carefully surveyed the route, and have decided that the line must pass over his property, so that, if he still refuses, you will have to seek compulsory powers. You may point out that, if he will now give his consent, you will meet his wishes so far as is possible with regard to the positions of the poles, whereas, if compulsory powers are obtained, you will please yourself where the poles are placed. This argument will often achieve success.

A point frequently raised by owners is that the rentals for poles are inadequate and that higher rentals are paid in other districts where they may have property. The only way to deal with this point is to fix definitely beforehand the rentals for arable land and meadows, and not to diverge from them under any consideration. If, in any particular case, a higher rental is offered, the news will soon spread, and innumerable difficulties will arise. It must be pointed out to each owner that the rentals are those prevailing in the district, and have been fixed by a committee and cannot be altered. The same argument applies in fixing compensation for the felling of trees along the route. A definite sum must be arranged as compensation for felling a tree, and this sum must not be altered in any circumstances.

X-ray Congress.

The annual congress of the British Institute of Radiology incorporated with the Röntgen Society will be held at the Central Hall, Westminster, on December 4th, 5th, and 6th, during which time there will be a full trade exhibition of X-ray apparatus. The Silvanus Thompson and Mackenzie-Davidson Memorial and other lectures will be given in the congress hall adjoining the exhibition.

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The G.I.P. Railway.

Electrification of the main lines from Bombay to Poona and from Bombay to Kalyan: the lines traverse difficult mountainous country and constitute the most extensive railway main-line electrification scheme within the British Empire.

THE electrified main-line system of the Great Indian Peninsula Railway, an important part of the Indian State Railways, was opened on November 5th by His Excellency the Governor of Bombay (Sir Frederick Sykes). A previous reference to this line was made in the Electrical Review of October 18th, when some general particulars of the scheme were given.

The electrified system, fig. 1, consists of three sections, *viz.*, the suburban, from Bombay to Kalyan (33 miles of quadruple track); south-east, from Kalyan to Poona over the Bhore Ghat (87 miles of double track); and north-east, Kalyan to Igatpuri (50 miles of double track).

The Ghats have always restricted communication between Bombay and the rest of India, and before the completion of the steam railway in 1853 the journey from Bombay to Poona lasted 24 hours. A reduction was then effected to six hours and it is anticipated that in the early future the time taken will be less than three hours. The ruling gradient over both Ghats is 1 in 37. The present scheme is the first instance of main line electrification in India and follows four years after the first suburban electrified line, the Harbour Branch of the same railway at Bombay, with which it is linked up, as it also is with the Bombay, Baroda and the Central Indian Railway.

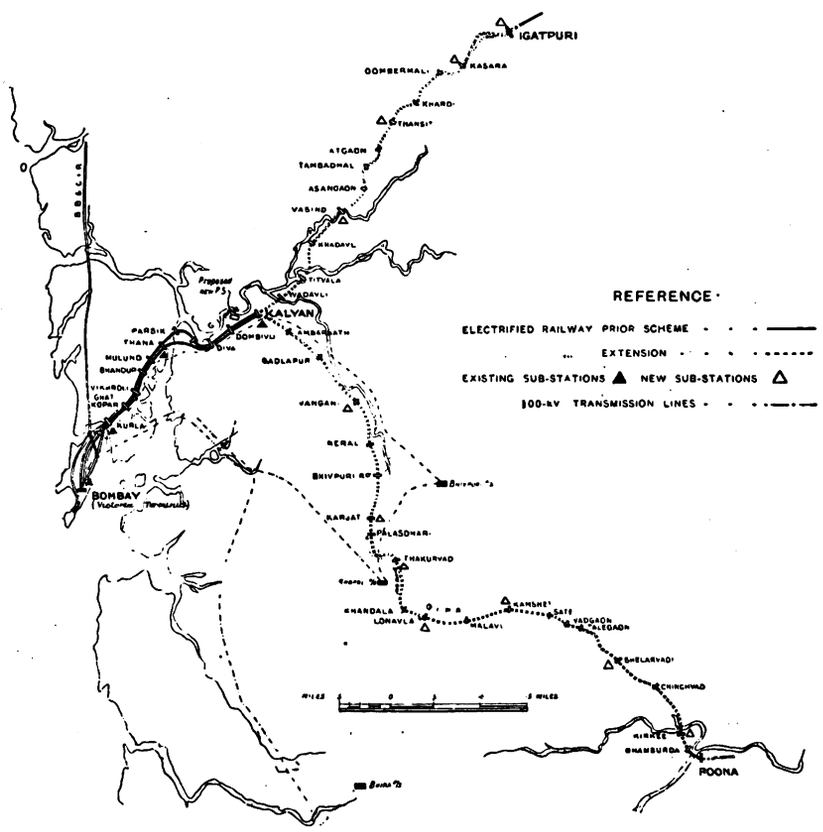

Fig. 1.—Route Plan of Electrified System.

Kalyan Power Station.—Power required for the railway beyond Kalyan is generated at a station near Kalyan (figs. 2 and 13) with a total plant capacity of 40,000 kW. Power required between Bombay and Kalyan is supplied by the Tata Power Co., Ltd.

The engine room and boiler house structure consists of a steel framework, cased with bricks, the boiler house being at right angles to the engine room. The contract for the building included a passenger and goods lift in the boiler house, a travelling crane in the engine room, and a basement runway. Six boilers are installed, normally fired with coal, each having an economical output of 60,000 lb. of steam per hour and a maximum output of 75,000 lb. of steam per hour at a pressure of 270 lb. per sq. in. and a total temperature of 725 lb. per sq. in. To meet the sudden and considerable fluctuations experienced with a traction load each boiler is in addition fitted with oil-fuel equipment, which is capable of producing an additional 30,000 lb. of steam per hour.

The boiler arches are of the "Liptak" suspended type, and each boiler is fitted with two travelling-grate compartment stokers fed with coal from overhead storage bunkers, a "Lea" type coal meter being fitted to each stoker. The oil fuel before passing to the burners is heated by steam, which is shut off by a thermo-static device when the oil reaches a definite temperature. Each boiler is fitted with four oil burners arranged in pairs at each side of the boiler. The turning of the handwheel to bring the oil firing into action also starts the oil burner forced-draught fans, speeds up the induced-draught fans, and clears out burners and piping with a blast of live steam.

The four boiler feed pumps are of the "Weir" turbine driven type, each capable of delivering 270,000 lb. of water per hour against a pressure of 280 lb. per sq. in. Each of the four turbines exhausts into three high-pressure feed heaters.

A Lassen-Hjört water softening plant provides for the treatment of the make up boiler feed water.

The engine room contains four three-phase, 6,600-volt, 3,000 r.p.m turbo-alternators, which machines are each capable of a continuous output of 10,000 kW at a steam pressure of 250 lb. per sq. in. and a temperature of 700 deg. F., with a maximum output for two minutes of 16,500 kW. Each turbine is complete with its own steam-driven oil pump for starting up purposes, surface condenser, air ejector, and water extraction pump, and the alternator has a self-excited exciter directly coupled to its shaft. In addition there are also two 415-volt, 350-kW, 9,000 r.p.m. non-condensing house turbine sets of the impulse type for the purpose of starting up the station in the first instance and after shut-downs. The alternators are driven through reduction gearing and run at 1,500 r.p.m., and in designing the insulation consideration was given to the fact that the sets may stand idle for long periods in a moist atmosphere.

The pump house (fig. 3) located on the side of the Ulhas River contains three 350-h.p. vertical circulating water pumps with a normal capacity of 16,000 g.p.m. and two of 175 h.p. with a normal capacity of 8,000 g.p.m. The intake is protected by three motor-driven inclined rotary screens. The circulating water system comprises three 42-in. cast-iron pipes, from which the condensing water

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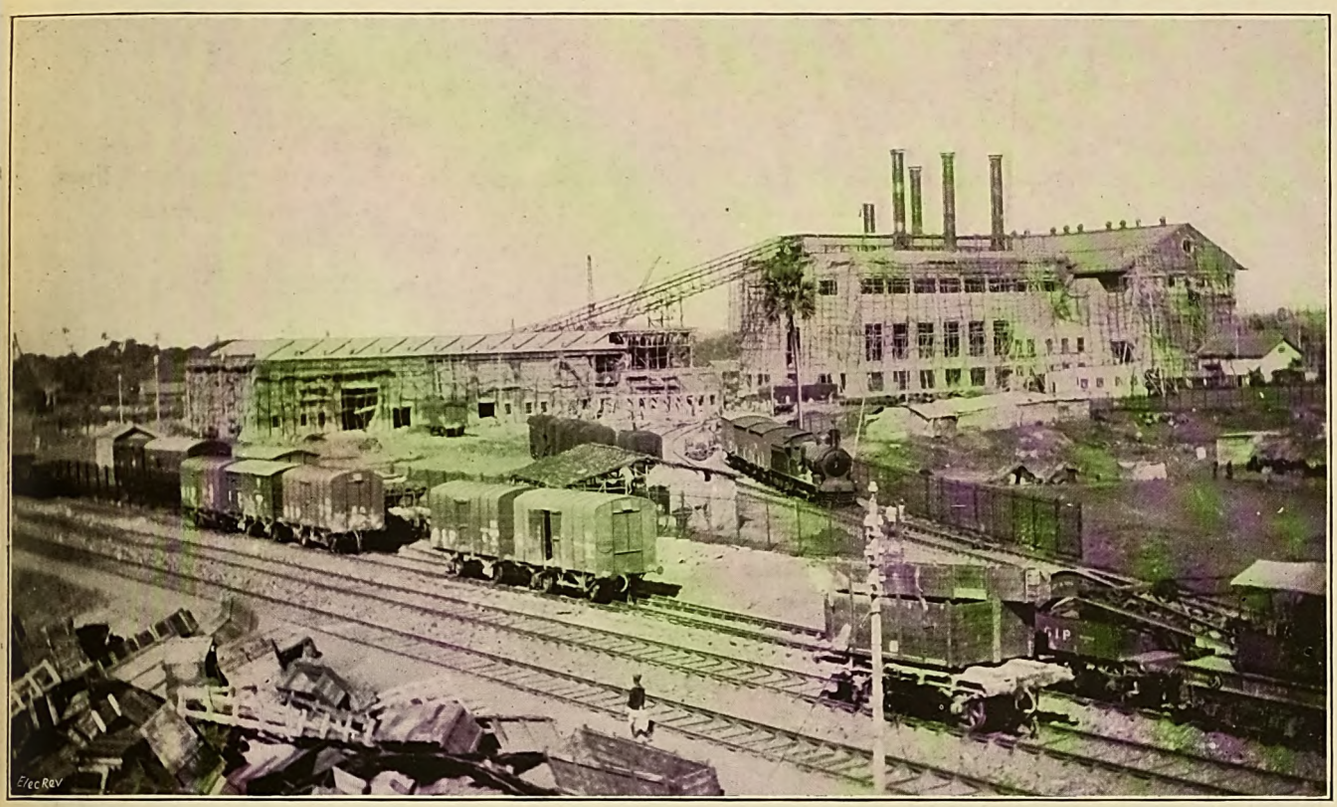

Fig. 2.—General View of Kalyan Power Station from the South-East.

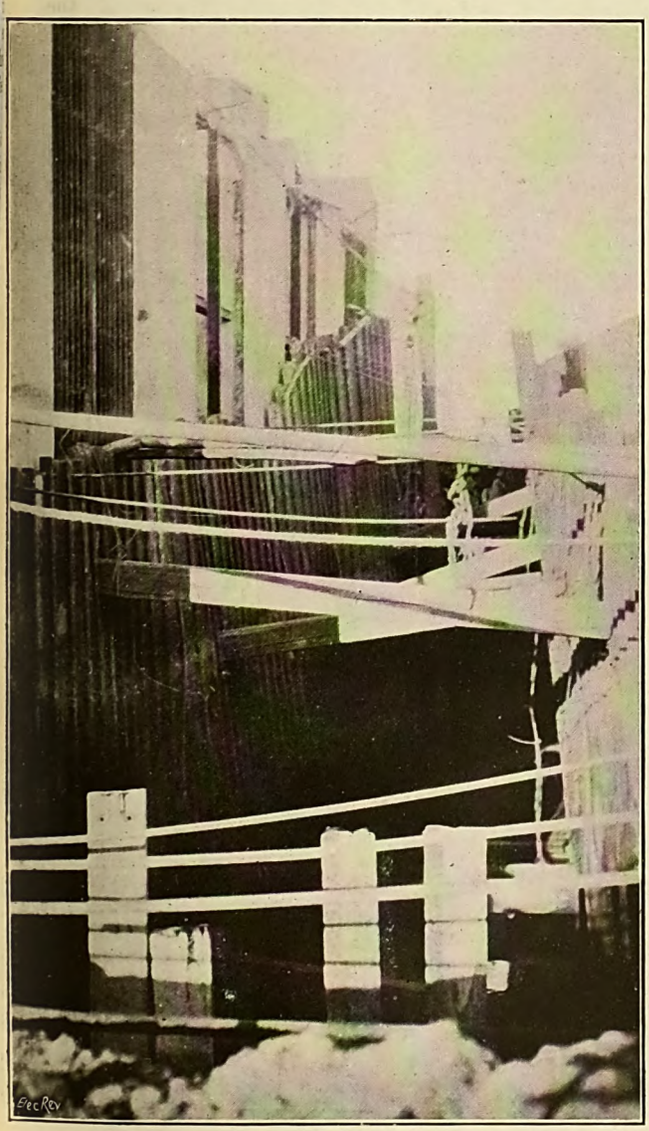

Fig. 3.—Front Wall of Pump House, Kalyan.

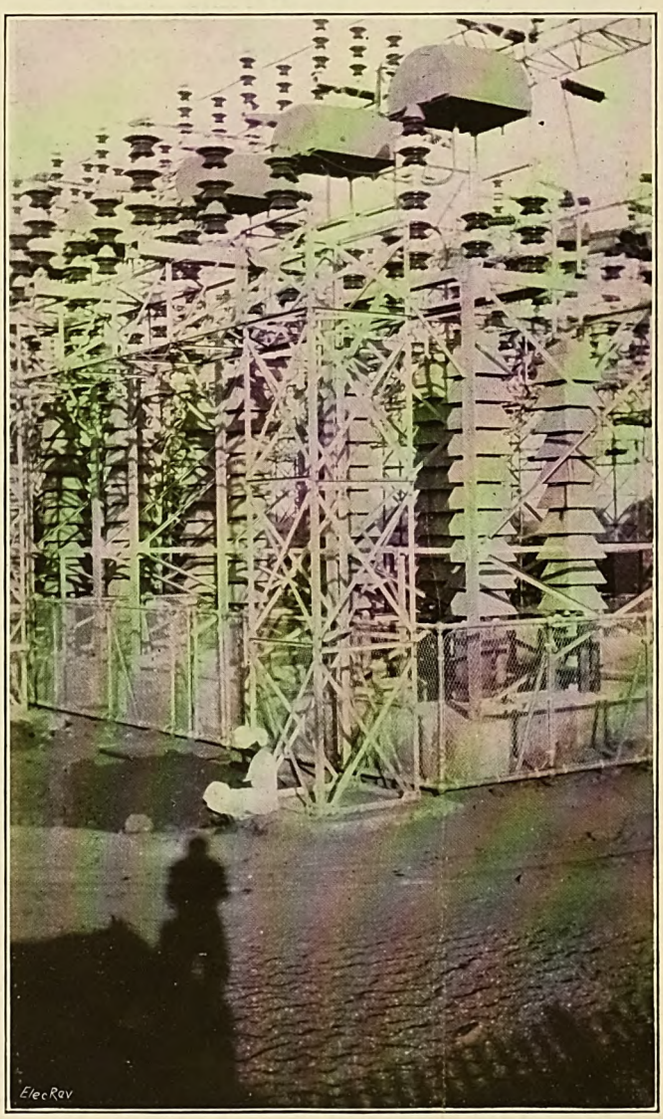

Fig. 4.—Lightning Arrestors.

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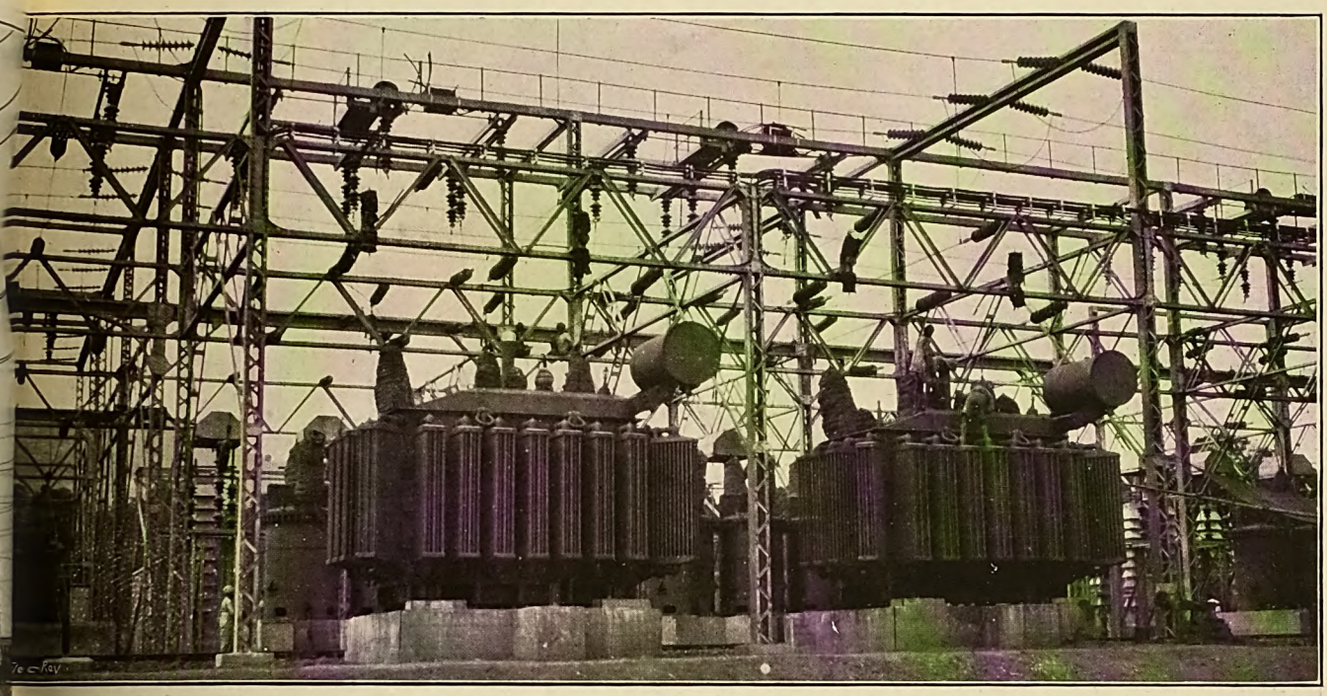

Fig. 7.—Step-down Transformers in an Outdoor Sub-station.

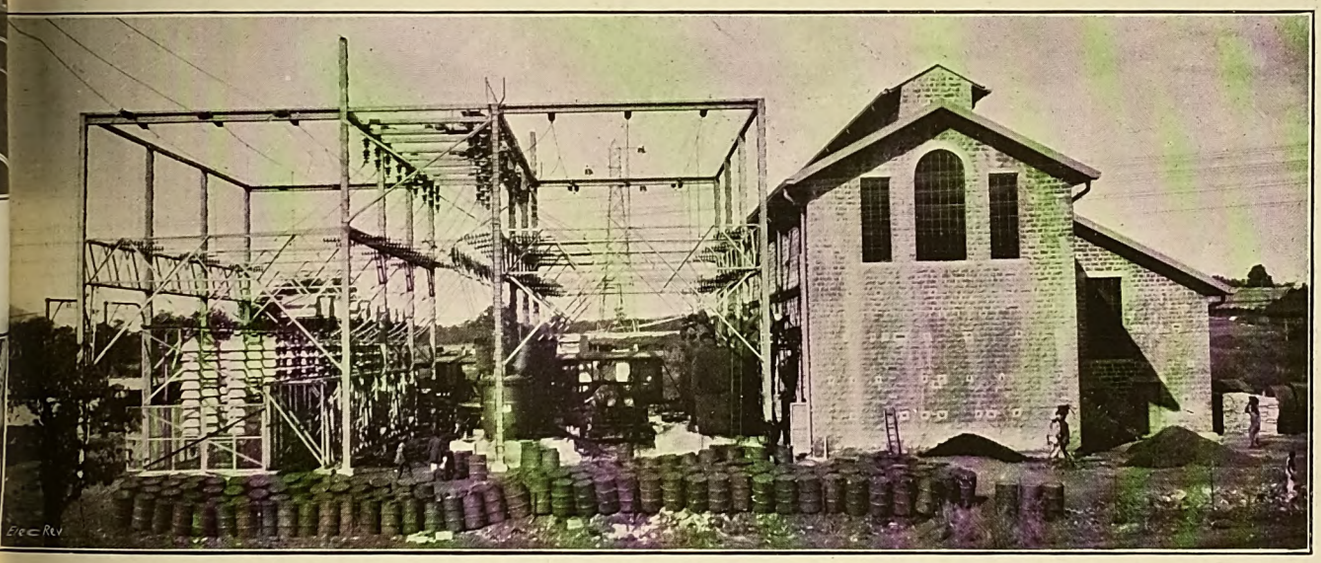

Fig. 8.—Sub-station at Vangani, showing Outdoor Plant.

Fig. 9.—The First Electric Passenger Train from Gonalva to Poona.

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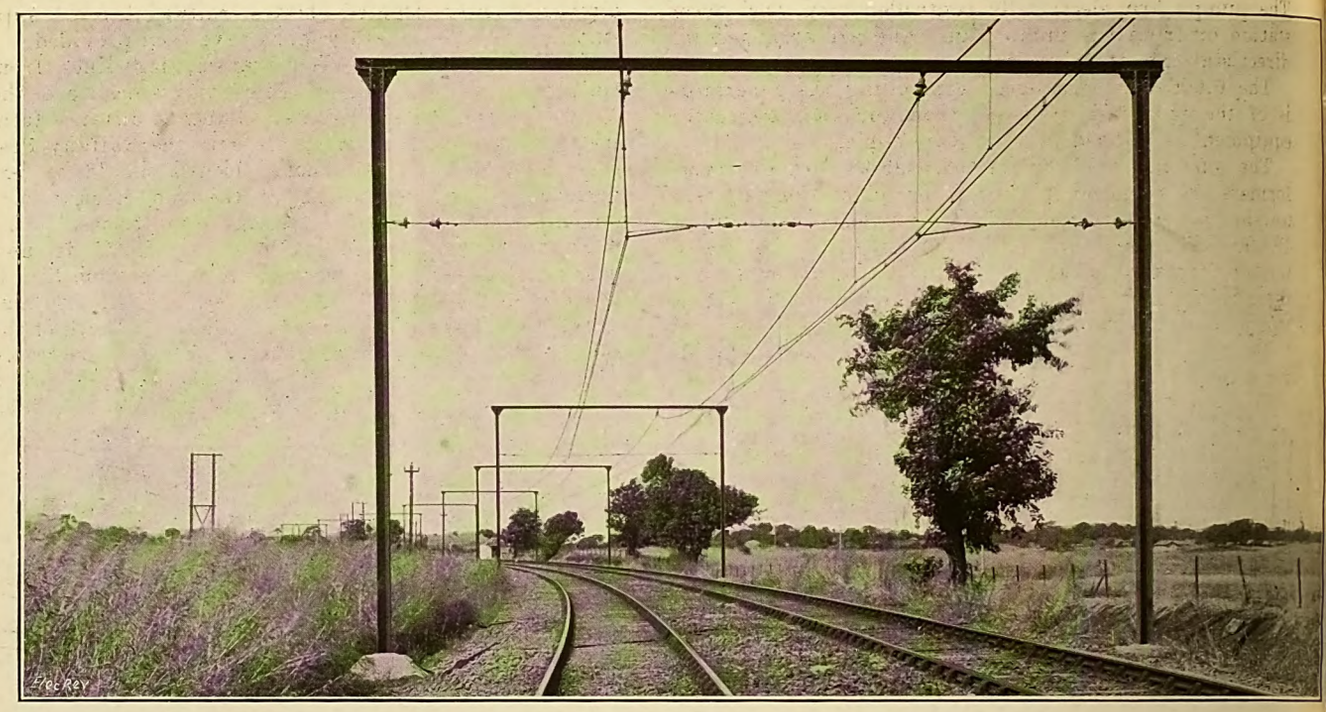

Fig. 10.—Curved Track Construction between Kalyan and Ambernath.

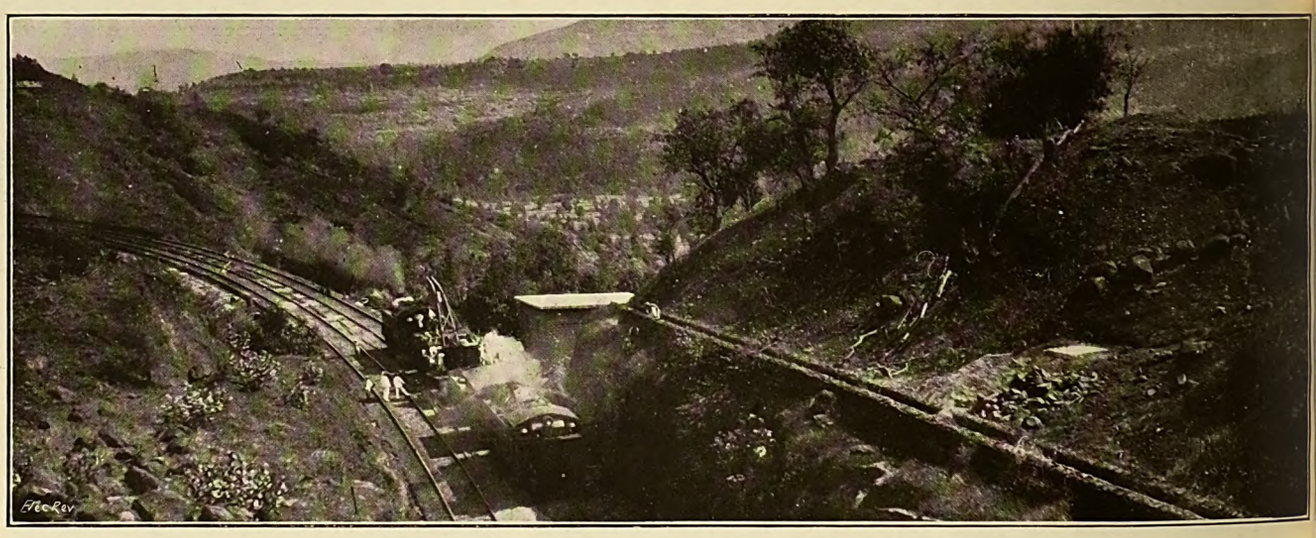

Fig. 11.—Special Train at Cabin on Lower Bhore Ghat.

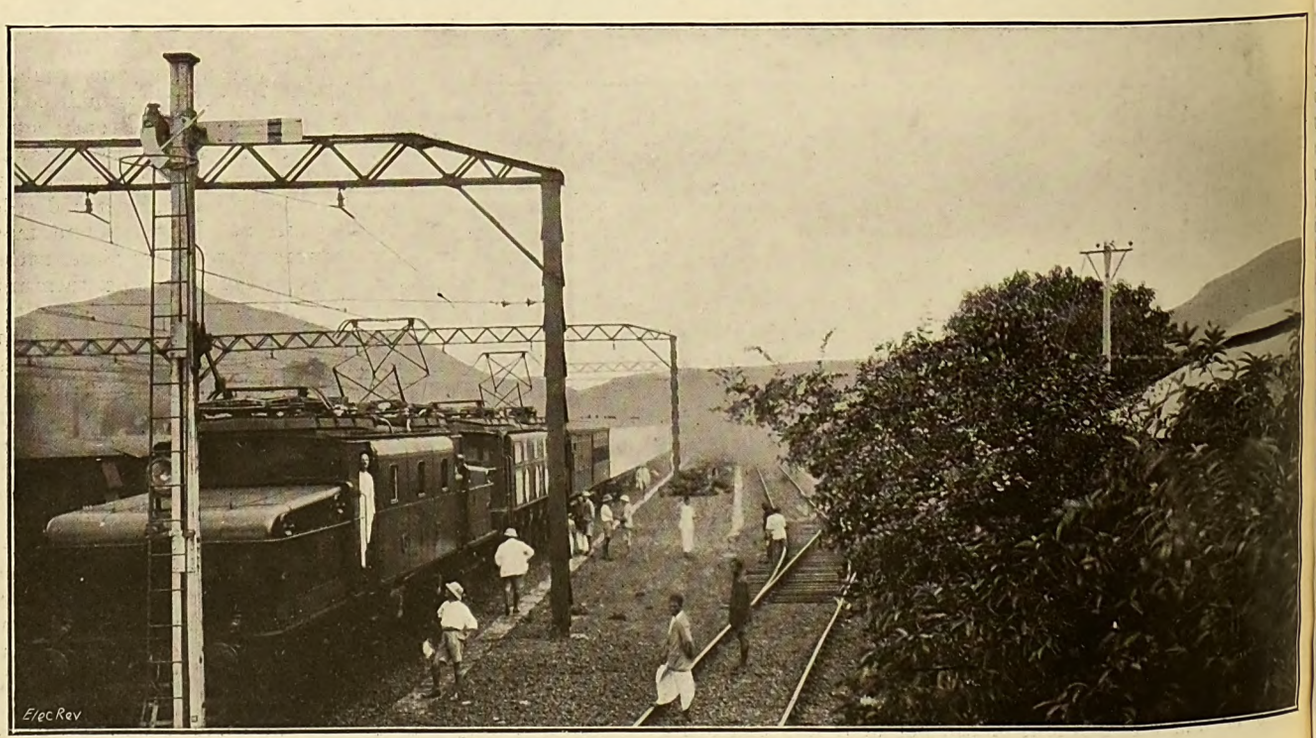

Fig. 12.—Arrival at Karjat of First Electric Passenger Train from Poona.

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is conveyed to the outlet further down the Ulhas River. The pumps are electrically controlled from the power station or from the pump house, and are arranged for direct starting at full voltage.

The 6,600-volt switchgear controlling the generators is of the ironclad draw-out type and each generator equipment is housed in a separate cubicle.

The four main 11,000-kVA 6.6/95-kV step-up transformers are situated in an outdoor sub-station adjacent to the power station. Their overload capacity is 18,000 kVA for two minutes. Each step-up transformer forms with its alternator a complete unit, there being no 6,600-volt busbars, and consists of three single-phase transformers.

The e.h.p. outdoor type switchgear has been designed for a pressure of 110,000 volts.

The auxiliary supply for the station is obtained by means of 6,600/415-volt 1,800-kVA unit transformers, one to each generating set and each feeding a separate unit switchboard. The two house turbine sets are also connected to the 415-volt switchgear, which controls the motor-generator equipments and the various auxiliary motors. Four 415/110-volt, single-phase, 25-kVA lighting transformers are installed, and also two 415/110-volt 25-kW motor-generators and a secondary battery for operating circuits, &c.

The coal is discharged into a steel plate receiving hopper situated between a line of standard gauge railway track, from which it is fed by conveyor to a junction tower. From the junction tower two travelling-belt (100 tons per hour) conveyors run to the overhead coal bunkers in the boiler house and one similar reversible conveyor to the coal storage ground. The coal is distributed and reclaimed from the storage ground by a steam-driven jib crane mounted on a caterpillar tractor and capable of dealing with 40 tons per hour.

The ash is continuously discharged from the stokers through chutes into tanks containing water in which paddle wheels operate, the outlets of the chutes from the stokers being sealed to prevent air passing to the boiler combustion chambers. The paddle wheels deliver the ash to two continuously running belt conveyors, each capable of dealing with six tons of ash per hour and extending the full length of the boiler house and terminating in a discharge tower situated above a railway track. As a standby two 10-cwt. ash wagons have been provided.

Transmission Lines.—The transmission lines from Kalyan run on both sides of the railway, except over the Ghat sections, and are situated at such a distance from the railway that no interference with the Railway Post Office telegraph and telephone circuits should be experienced. The separation of the two circuits also minimises the likelihood of damage from storms. This work, which was started in November, 1927, is now nearly completed. The working voltage of this line is between 95,000 and 100,000 volts, being similar to that of the Tata Power Co.'s system. The total length of the transmission lines is approximately 270 miles, and there are some 2,000 towers, each about 75 ft. high, with a normal span of 700 ft. On the Bhore Ghat, it was decided that an additional line should be installed, which could be brought into operation in the event of any trouble occurring on the normally used circuits. In the construction of the line over the Ghat there is a span between towers of 1,750 ft. The conductors consist of stranded aluminium cable with a steel core, and altogether 840 miles of conductor wire was required. It was found more convenient to build the towers up piece by piece, rather than to assemble them on the ground and hoist them into position.

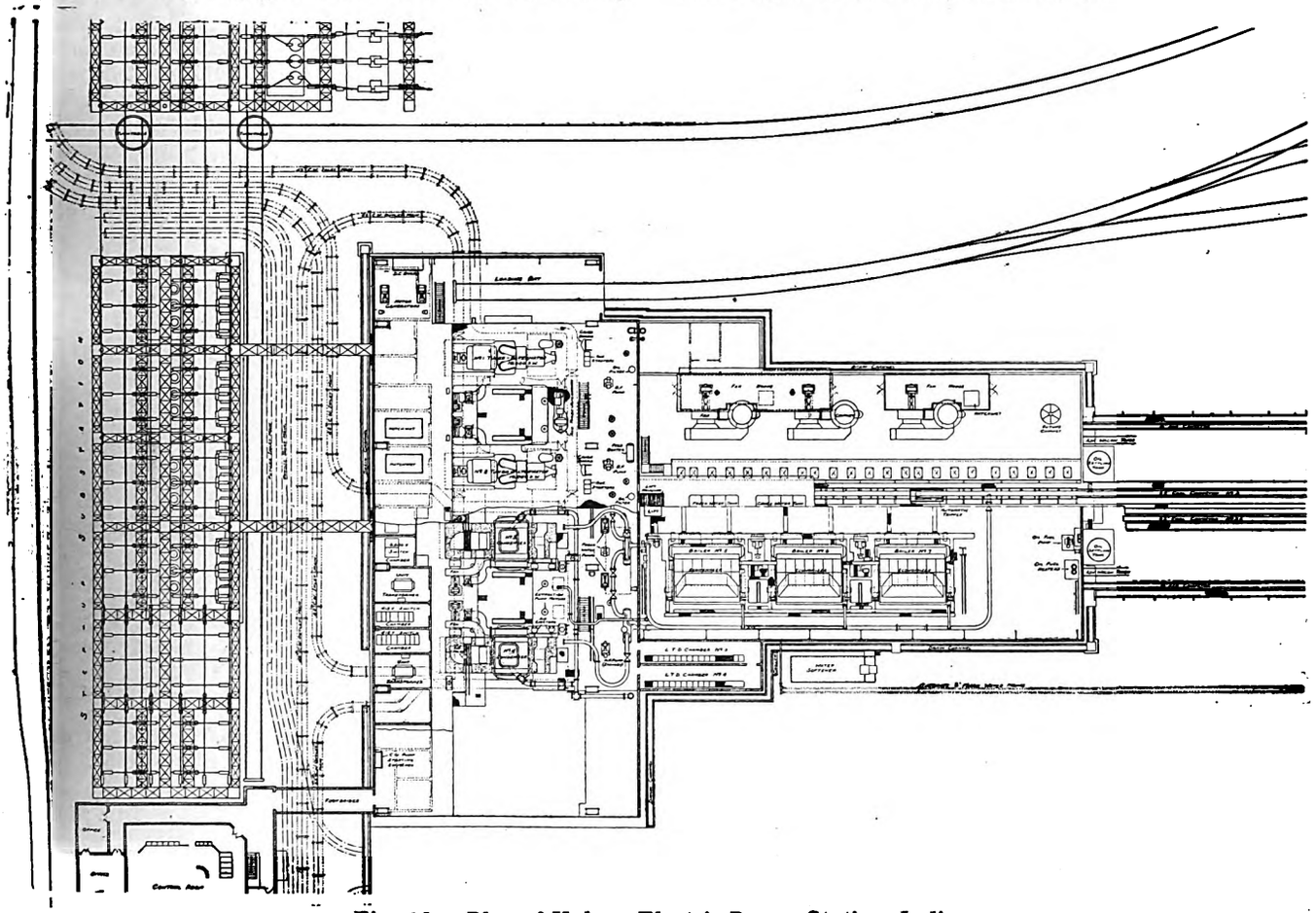

Fig. 13.—Plan of Kalyan Electric Power Station, India.

Sub-stations.—The supply of power to the railway track overhead conductors is provided by 11 sub-stations. The average distance between them is about 12 miles. The sub-station buildings have a steel frame and the walls are composed of stonework. The work of erecting the sub-station buildings, track sectioning, and lightning arrestor cabins was carried out by the chief engineer's department.

All the sub-stations, except Thakurvadi, receive their 100,000-volt supply from the power station by means of tee connections from the duplicate transmission lines. These connections terminate on the structure of the outdoor sub-stations, figs. 7 and 8, in which are the 110-kV oil switches and isolators and also the step-down rotary-convertor transformers.

Each rotary-convertor set in a sub-station consists of

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two 750-volt rotaries connected in series. A fan mounted on the armature forces over 10,000 cubic feet of filtered air per minute through the machine. Each rotary convertor set has a capacity at a continuous rating of 2,500 kW, *i.e.*, 1,666 amps., for one hour of 2,900 amperes, and momentarily of 6,000 amps.

The 1,500-volt, d.c., high-speed circuit breakers are of the draw-out truck type, and it is anticipated that in addition to rapidly isolating any faults which occur on the overhead equipment they will also prevent damage from lightning. Of the 11 sub-stations, six are operated from the five attended sub-stations by means of a supervisory control system, the wires for which are carried on the structures supporting the track equipment.

Adjacent to the track at each sub-station is a small cabin in which are housed the lightning arrestors (fig. 4) for the protection of sub-station equipment. Midway between each sub-station is situated a track sectioning cabin which contains four high-speed circuit breakers, of a similar type to those in the sub-stations, for interconnecting the tracks so as to make the highest possible use of the track copper conductivity. These cabins are under the control of adjacent sub-stations.

of the conductor are of copper or some other non-ferrous metal.

Some 8,000 tons of steelwork is required for supporting the equipment, and about 3,200 tons of copper is required in the form of conductors alone.

The relative cost of the overhead equipment of the permanent way can be gauged from the fact that, out of a total expenditure on the electrification scheme of about £8,000,000, the cost for this portion came to £2,000,000.

The equipment is arranged for current collection up to 80 miles per hour.

The return circuit of the current is by means of the running rails, which are bonded by two copper bonds under each pair of fishplates.

The principal contractors and sub-contractors for the electrification scheme were :—Steel framework for power station buildings, boiler house equipment, and coal and ash handling plant, Babcock & Wilcox, Ltd.; engine room plant, C. A. Parsons & Co., Ltd.; pump house, Mirrlees-Watson Co., Ltd.; motors, British Thomson-Houston Co., Ltd.; transformers, Metropolitan-Vickers Electrical Co., Ltd.; switchgear and outdoor sub-station steel-work, English Electric Co., Ltd.; transmission

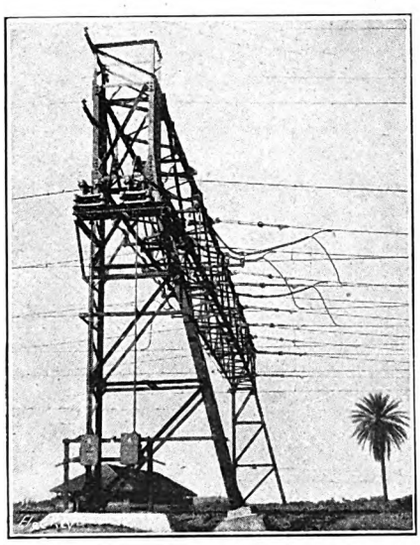

Fig. 14.—Four-track Anchor Structure equipped with Two Section Switches.

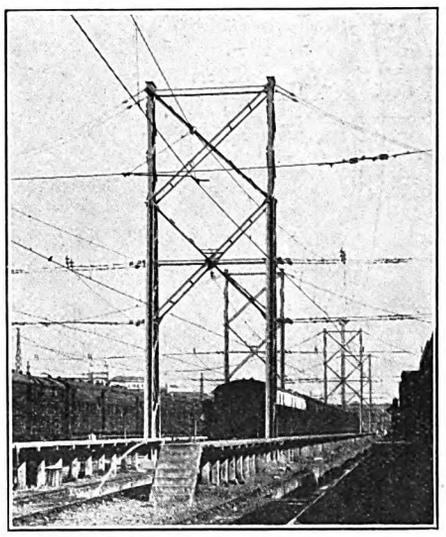

Fig. 15.—Portal Structure at Victoria Terminus, Bombay.

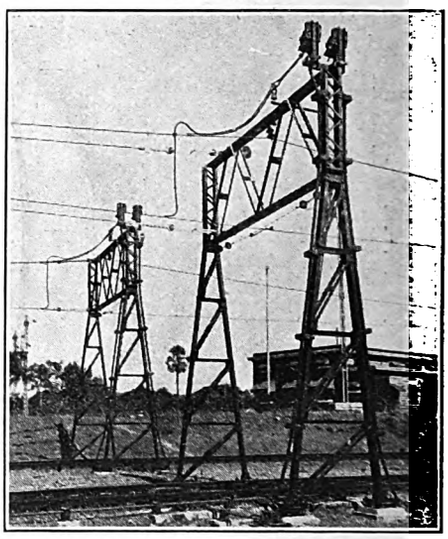

Fig. 16.—Single-track Anchor Structure at Kalyan Feeding Point.

One sub-station at Thakurvadi, about midway up the Bhore Ghat, which, owing to the physical features of the country, could not be fed from the 100,000-volt transmission line, is supplied by means of a 22,000-volt transmission line from Karjat sub-station, where two special outdoor transformers are installed for this purpose.

A special device is installed in the Karjat sub-station which, in the event of the frequency of the system exceeding a predetermined value due to power regenerated by the locomotives exceeding that absorbed by the system will cause artificial load to be thrown on.

Telephone communication with the power controller is available from each sub-station, and no switching operations are carried out except under his instructions.

Overhead Equipment of Permanent Way.—The overhead track equipment (figs. 5, 10, 14, 15 and 16) has several novel features. The total section of copper carried per main-line track is one square inch divided into three parts: .5 sq. in. main catenary, .2 sq. in. auxiliary catenary, and .3 sq. in. contact wire, composed of British standard section wire. The main catenary is suspended at 220 ft. intervals by double porcelain disk insulators of the ball and socket pattern, and the contact wire is suspended by loop type contact wire clips from the auxiliary catenary, thereby providing an exceedingly flexible line. The contact wire and catenaries are tensioned off at approximately every mile, the continuity of contact being made by a patented form of overlap span, which permits some of the tension stresses to be balanced, so reducing to a minimum the amount of steel required in the structures at such points. All metal fittings used for the attachment and suspension lines, W. T. Henley's Telegraph Works Co., Ltd.; sub-stations and track-sectioning cabins, British Thomson-Houston Co., Ltd.; overhead equipment of permanent way (including suburban section), British Insulated Cables, Ltd.; locomotives, Metropolitan-Vickers Electrical Co., Ltd.

(*To be continued.*)

Levelling Errors in Sub-station Instruments.

The accuracy of dynamometer type instruments are greatly affected by any departure from the exact level, a variation in accuracy of 0.2 per cent. being caused by such quite small changes as 0.5 or one degree. The error being so small and the cause unsuspected, the inaccuracy is difficult to trace. Therefore Mr. W. E. Warner advises that when testing such instruments the exact level should always be checked, as errors in levelling are a common cause of inaccuracy. The error may have been made when installing the instrument, or have developed in service. The insulating and adhesive varnishes used for impregnating the various parts and for attaching the pivots may easily distort in drying out. They are also affected by the atmospheric temperature, humidity, and the warming due to the electrical load, which cause the inaccuracy to differ on different days and also on different ranges of the instrument. Tests should therefore always be carried out under as nearly identical conditions as possible.

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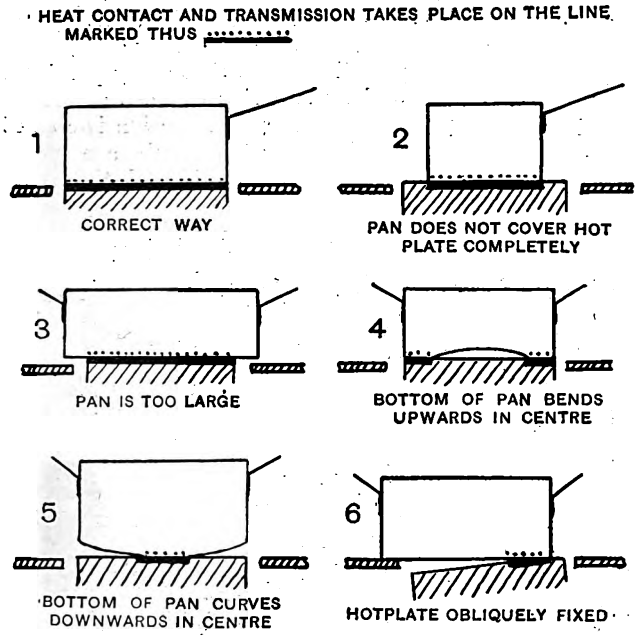
Electricity for the Home.

Examples of manufacturers' recently introduced products, with special reference to the provision of specially designed cooking utensils for use on boiling plates.

Specially Designed Cooking Utensils.

The accompanying graph, fig. 1, sets forth the advantages to be derived from the use of specially prepared utensils in connection with cooking by electricity, and, conversely, the wasteful results which are bound to be produced if the warning is ignored and any old kettle or pan is utilised. It also depicts the proper use, and also the abuse, of the totally-enclosed electric boiling



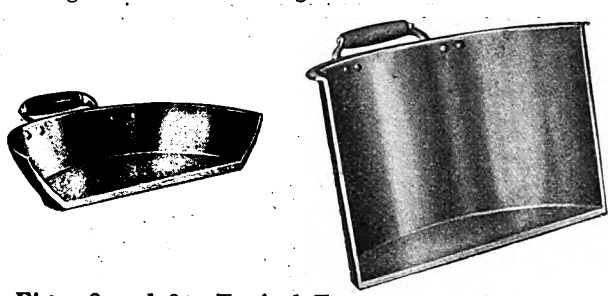
Time and Cost chart in respect of the boiling of 4 pints of water with a hotplate, size 8¼" diam., with a loading capacity of 1,800 W. Assumed cost of electric current: (*a*) 1d. per unit; (*b*) 1½d. per unit.

In order to bring 4 pints of water (taken at 55° F.) to the boiling point of 212° F. it requires.				Efficiency obtained.	Waste of time and expense, based upon the correct figures shown under illustration No. 1.
Sketch.	Time in minutes.	Consumption of energy in watts.	Cost in pence.	Percentage.	
1	9.5	0.282	*a.* 0.282 *b.* 0.423	75	0 (correct)
2	10.75	0.322	*a.* 0.322 *b.* 0.483	65	13
3	13	0.392	*a.* 0.392 *b.* 0.588	54	37
4	23.5	0.705	*a.* 0.705 *b.* 1.06	30	147
5	22	0.665	*a.* 0.665 *b.* 1.00	32	132
6	16.5	0.495	*a.* 0.495 *b.* 0.742	43	74

Fig. 1.—Correct and Incorrect Use of Utensils with Enclosed Boiling Plates.

plate, and it supports the view that supply authorities and cooker manufacturers should co-operate in order to educate consumers in how to obtain maximum efficiency at the lowest current consumption. The argument is often advanced by the housewife who has changed over to electric cooking, "why should I go to the further expense of buying new pots and pans when I still have my old ones, which seem to be in quite good condition?" Unfortunately, the salesman is often not sufficiently interested to bring it home to his new client that the acquisition of a totally new set of pots and pans specially manufactured for use with the cooker is not a waste, but an investment which will yield a high interest return in the form of vastly increased efficiency and great saving of time and temper.

Careful research work and laboratory experiments with flat-bottomed specially-drawn (not cast) aluminium utensils, as compared with the ordinary type of kettles, pans, &c., now used on gas stoves, have produced results which support the argument that the extra cost entailed by the purchase of a set of suitable utensils is very speedily amortised. The following may serve as an example:—A kettle with ¼-in. thick machined bottom, 8 in. diameter, and containing 3 pints of water, was placed on an 8 in. diameter "Margo" totally-enclosed boiling plate having a loading capacity of 1,600 watts. The contents were brought to boiling point in ten minutes, the current consumption being slightly over ¼ unit. Making the same trial with a boiling plate with a loading of 1,800 watts the water boiled in 8½ minutes. Tests were thereafter made with an ordinary gas kettle, three pints capacity, having an ordinary thin unmachined, but fairly flat bottom, likewise 8 in. diameter. Being placed on a similar totally-enclosed boiling plate (by Messrs. De Brunner & Lang-Sims, 3 & 4, King Street, Covent Garden, W.C.2) 8 in. diameter, with a loading of 1,600 watts, it took 20 minutes to raise the water to boiling point, the current consumption being more than twice what was necessary in the first trial. The tests were continued with this gas-cooker kettle, and it was speedily shown that the consumption necessary to raise the 3 points of water to boiling point constantly increased from trial to trial, inasmuch as the bottom of the utensil began to warp, and the more the bottom became deformed the worse the contact, and, incidentally, the larger the waste and the longer the time to bring the contents to the boil.



Figs. 2 and 3.—Typical Examples of "Margo" Utensils.

These striking figures should readily bring home the only possible conclusion that the saving which can be effected will speedily pay for the cost of the proper implements needed to get maximum efficiency. Figs. 2 and 3 show typical examples of the "Margo" utensils, a half section being depicted in each case.

Another company which is marketing a range of specially designed cooking utensils for use on electric boiling plates is SIGG, LTD., 469, Holloway Road, N. These utensils have ¼-in. thick bottom plates which are machined perfectly flat. The following figures have been obtained by a series of tests with a number of boiling plates using a "Sigg" (inflexible) "Leicester" machined-flat aluminium kettle in each test. The boiling plates were wiped clean of oil, grit, &c., as also was the ground-flat base of the kettle. The loading of the plate was adjusted, irrespective of voltage, to exactly 2,000 watts, and the plate, kettle and water were in each case at 60 deg. F. The following boiling times were obtained:—½ pint, 4 min. 39 sec., 18.8 per cent. efficiency; 1 pint, 5 min. 35 sec., 30.3 per cent. efficiency; 1½ pint, 6 min. 35 sec., 38.6 per cent. efficiency; 2 pints, 7 min. 40 sec., 44.2 per cent. efficiency; 2½ pints, 8 min. 40 sec., 48.7 per cent. efficiency; and 3 pints, 9 min.

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45 sec., 52.2 per cent. efficiency. The above tests were made by Revo Electric Co., Ltd., who make the following comments:—"The test results enclosed have been obtained in our own laboratory, where all conditions are under our control, and we can, therefore, vouch for their accuracy. The times given are, we may say, a considerable improvement on anything we have obtained with

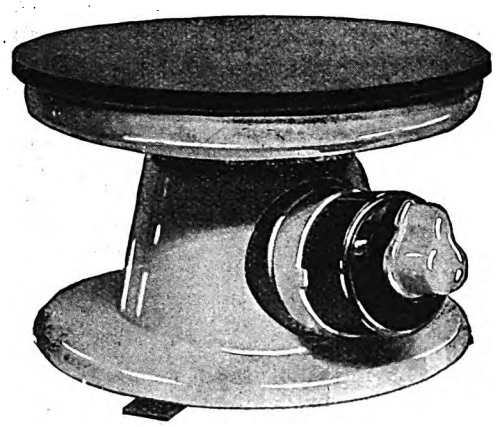

Fig. 4.—A "Sadia" Table Stove.

other utensils, and we intend to continue the tests with our other sizes of plates."

Recent "Sadia" Developments.

Among the many recent additions to the products of Sadia, Ltd., 22, Newman Street, Oxford Street, W.1, is a range of boiling plates adapted for table use. The type illustrated in fig. 4, is white enamelled and fitted with a 3-heat switch. It is obtainable in four sizes, *viz.*:—boiling plate diameters of $6\frac{1}{4}$, $7\frac{1}{8}$, $7\frac{7}{8}$ and $8\frac{3}{4}$ in., having respective loadings of 800, 1,000, 1,300, and 1,600 W. Another type is designed to be used as a table plate or an auxiliary plate on any electric cooker. It can be clamped on to the side of a table or hob and is plugged in the same way as an electric kettle. It is made in one size only—$4\frac{1}{2}$-in. diameter plate—and has a loading of 550 W.

An Improved Electric Cooker.

An electric cooker which the Revo Electric Co., Ltd., Britannia Works, Tividale, Tipton, has recently introduced is being used extensively by municipalities in

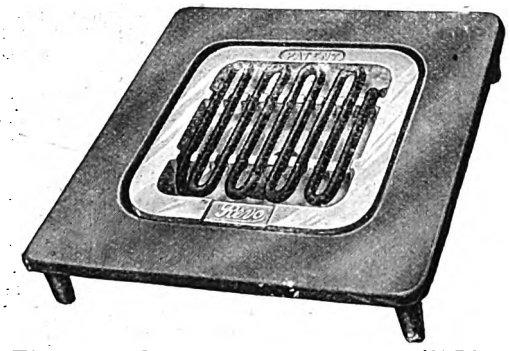

Fig. 5.—The Revo "Superspeed" Plate.

connection with their domestic supply schemes. This cooker is vitreously enamelled inside and out, but its principle feature is the inclusion, in addition to a "Sadia" plate, of the "Superspeed" plate (fig. 5). The sole purpose of this plate is to provide rapid means of heating small quantities of water. The element is operated through a transformer which reduces the supply voltage to 10 V, and for this low voltage a heavy nickel-chromium resistance wire (0.2 in. diameter) is used. The natural oxide which forms on the surface of the wire is sufficient at so low a voltage to prevent short-circuits. The transformer is of the double-wound pattern. A 3-wire selector switch is fitted on the primary side to provide 3 degrees of heat. The secondary circuit of the transformer is earthed to ensure freedom from shocks which might otherwise occur through capacity. From the transformer, which is placed below the oven, two heavy copper conductors convey the current to the boiling plate. In this circuit laminated cooling fins are provided to prevent the heat from the element being conducted down to the transformer. The extra cost of the transformer is more than balanced, it is claimed, by the absence of repairs to spirals which occur in the ordinary type of boiling plates.

The manufacturers state that additional advantages of the plate are that the red hot visible element appeals to the housewife more than enclosed boiling plates. Owing to the heavy construction of the wire, concentrated heat is attained in a small space, and owing to the freedom from danger of short circuits, the element may be brought extremely close to the base of the utensil.

A New Electric Washer.

The new "Efesca Easy" electric washer recently introduced by Messrs. Falk, Stadelmann & Co., Ltd., 83 to 93, Farringdon Road, E.C.1, is worked on quite a new principle. The washing is done by means of vacuum cups which are attached to tubes and work up and down at the rate of 60 times per minute. These vacuum cups, on striking and rising from the water, create air pressure and ensure, it is claimed, perfect cleaning. Every time the cups reach the bottom of the stroke they change position (twenty times per minute), so that every portion of the washing comes under the action of the vacuum and air-pressure cups. On the up-stroke suction is created, and the clothes at the bottom of the tub are drawn upwards—thus every piece is moved, and thoroughly

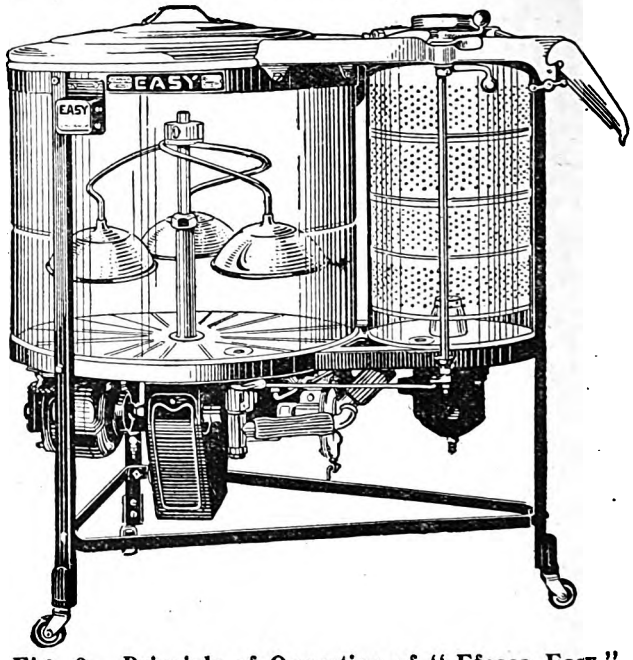

Fig. 6.—Principle of Operation of "Efesca Easy" Washer.

washed. The delicate operation of these cups (which has been likened to the opening and closing of ladies' hands) makes it possible for the most flimsy lace, delicate silk, or the most expensive fabric, to be washed thoroughly without fear of deterioration. The chamber adjoining the washing container is used for drying. This is composed of an inner perforated tank, comprising an up-to-date centrifugal dryer; this dryer can be packed with clothes which will be damp dried ready for ironing or airing in three minutes. This operation is claimed to be far more efficient than any mangle, and buttons cannot be crushed or broken, and no creases will be formed in the washing. It ensures, it is claimed, absolutely even drying without labour, and all the water whirled out of the clothes is returned to the washing tub. To rinse and blue is the work of a few minutes, and the machine can be emptied, either from the exhaust vent provided, or from the draining board, as required, a pump being fitted for this purpose. There is no manual work whatever required for washing and drying—the "Easy" motor and pump undertake all operations. A heating arrangement is fitted under the washing container maintaining the water at the correct temperature during the whole washing operations. The principle of operation of the washer is shown in the accompanying illustration, fig. 6.

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Design of Steel Structures.

Mechanical factors to be taken into account when designing outdoor sub-stations.

By H. E. Hutter.

THE following notes are intended to supplement the very meagre literature on the above-named subject, and are based on many years' experience.

The practice in this country is to build structures up to a maximum height of approximately 20 ft. of standard sections, and above that to build entirely of lattice work girders and towers, whilst American practice favours the combination of both.

The structure should be designed on the assumption that all loads act at the same time, so that in that condition excessive deflection may not occur. The pull of the incoming lines should be kept as low as possible, in any case not exceeding 1,000 lb.; if it is wished to keep the weight within reasonable limits, it is much cheaper to place an anchor tower near to the station. The wind loading is a variable factor depending on the location of the station, and should be calculated on 1½ times the projected areas of the steel structure and on the projected area of all apparatus; a good figure for this country which has been used on the grid transforming stations is 25 lb. per sq. ft. The U.S.A. is divided into belts as regards wind and snow loadings, the wind pressures being for the worst district 16 lb. per sq. ft., and for the medium district 13 lb. per sq. ft.

The dead loads are the weights of the apparatus and of one or two men for erection, &c. (weight of a man 200 lb). If considered necessary allowance can be made for the weight of snow on the structure and equipment, and a weight of 5 lb. per sq. ft. could be used in this country. Allowance should also be made for the impact which occurs when mechanically-operated air-break switches are opened and closed, a figure of 40 per cent. of the equipment weight being a sound correction.

Busbars, if of tube resting on post insulators, are taken as a simple dead weight, but, if made up of cable, a tension of 1,000 lb. is barely sufficient to take out the slack in the cable; a figure of 2,000 lb. will meet every case for high-voltage stations, and will also give an allowance for extra loading in bad weather.

The structure can be entirely self-supporting, or rely on diagonal braces for rigidity; a recent example of the latter type is the new transforming station at Dalmarnock, in which there are braces between each bay. A tower having a section of 2 ft. 6 in. square requires bracing, whilst the same structure having legs 4 ft. square is self-supporting.

The steel used in this country is, with the exception of that used for cheap jobs, B.S.S. No. 15, grade A, and the most commonly used unit stresses are: bearing on bolts 24,000 lb. per sq. in., shearing stress 12,000 lb. per sq. in., tension 15,000 lb. per sq. in. on net section. The compression stress is usually based on one of the stanchion formulas; a common formula is $17{,}000 \div 70\ L/R$ lb. per sq. in., the ratio L/R being usually limited to a maximum of 125 for main legs, and to 150 for other members having calculated stresses; the minimum thickness of legs should be ¼ in. and for other members 3/16 in., bolts should not be less than ⅝ in. dia., hexagonal heads with lockwashers; the factor of safety against overturning or uprooting should be 21/2.

The bases of columns should be of angle iron and plate not less than ⅜ in. thick, the stress on the concrete not exceeding 150 lb. per sq. in. By far the best way is to use holding down bolts in preference to cementing in the stubs of the columns; the last method requires a high degree of accuracy if the remainder of the structure is to be erected easily; the base plates can be grouted up 1 in. thick after being correctly located.

In order to provide access to the gear, ladders should be placed at suitable places; a ladder composed of side members 2 in. by ⅜ in., 12 in. wide, with rungs at 9 in. centres is ample; alternative methods are bolts in one face of an angle or pieces of angle bolted across a tower.

After the completion of the design the very important point arises as to what finish shall be given. It is impossible to lay down fixed rules, but the two tried methods are coating with zinc by some method, or the use of paint. Usually the best method is galvanising, but sometimes the atmospheric conditions will not permit its use, for instance, in some parts of the Midlands. The most common methods of galvanising are the hot-dip process, in which each piece is treated separately, or the Schoop method, in which the zinc is sprayed on to the sections by means of a pistol, by which means the metal is atomised in a gas flame and blown out by an air jet. The essentials of a suitable paint are that it must remain flexible under all conditions and also be able to resist corrosion; the paints used are those with a bitumen base or else red lead and oil. Nuts, bolts, and washers should be galvanised, the threads of the bolts being either treated with a heavy oil or galvanised.

Reviews.

Cable Research Handbooks. Vol. I. Rules, Regulations and Specifications Affecting the Supply and Distribution of Electricity. Pp. viii+591. Illustrated. London: Commercial Secretaries, Ltd. Price 21s. net.

This handbook is styled "Volume I," which we hope means that it is to be the forerunner of a series of handbooks giving data regarding every aspect of cables. It has been compiled by Cable Research—a body formed in 1927 by eight of the leading cable manufacturers for the purpose of joint research and interchange of information.

As stated in the foreword, the book contains all the more important rules, regulations and specifications governing the manufacture and utilisation of cables and conductors required for the transmission and distribution of electrical energy. The hope which is expressed that "the bringing together of matter hitherto only available in a variety of separate publications will prove of value to everyone interested in cables" will, we are sure, be amply realised.

Such a collection is a reminder of the variety of regulations with which the electrical engineer must comply. Perhaps the example which this volume most clearly shows up is that of the "I.E.E. Regulations for the Electrical Equipment of Ships" and "Lloyd's Rules for Electric Fittings." The latter endorses the former in nearly every respect, but one is left wondering why Lloyd's will not permit a fittings wire less than .001 sq. in. (p. 341) whilst the I.E.E. allows as small as .0006 sq. in. (p. 299) for this purpose. Again it seems strange that Lloyd's accept the I.E.E. Tables of Permissible Currents for Intermittent and Continuous Rating of Cables, but amend that of the maximum permissible for flexibles, see pages 300 to 301 and 356 to 357. Such differences, small though they be, must be irritating and it appears strange that Lloyds cannot accept the I.E.E. Regulations in their entirety.

With one curious exception the compilers have thought it best to include every rule complete with all tables and schedules. This has led to a great deal of repetition. For the most part we agree with their decision, but it seems *somewhat unnecessary* that the overhead line regulations made by the Electricity Commisioners should be printed in full on pages 28 to 30 and again on pages 48 to 53, and a *mistake* to include the obsolete regulations of the same authority on pages 205 to 210 as an appendix to the Home Office Regulations. It also seems hardly necessary to give the tables of resistance and temperature co-efficients in degrees Farenheit three times over, *viz.*, pages 364 to 366, 417 and pages 431 to 433.

The one exception to the compilers' general rule is in connection with the British Standard Specification No. 7 for insulated conductors.

The extract from the glossary which forms part of this specification is omitted and embodied with various other terms and definitions at the end of the handbook. Unfortunately an error has been made in the cross reference on page 362, and in view of the importance of these definitions to the cable user, for whom this book has been compiled, an errata slip should be inserted.

A book of this description will certainly require revising at frequent intervals and we venture to make one or two suggestions for future editions.

First, a headline on each page giving a short title of the regulations or specification dealt with thereon would be of great help.

Secondly, the inclusion of the London County Council regulations for theatres and places of public resort would be a welcome addition.

Thirdly, since a large number of the clientele of the compilers use Continental and American units, a table showing at a glance customary sizes of British, Continental, and American cables in juxtaposition would be of great value. So far as we know there is only one publication in which such a table is given, *viz.*, "Glover's Vade Mecum," which is issued by one of the members of "Cable Research," but, unfortunately, this table is based on the British Standards

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of 1910, since when many changes have taken place, including the adoption of the International Copper Standard for Matthieson's.

In conclusion the book is extremely well printed and of handy desk size and is a very welcome addition to the electrical engineer's library.

Telegraphy and Telephony, including Wireless Communication. By E. MALLETT, D.Sc. (Eng.), London. Pp. ix+413; figs. 287. London: Chapman & Hall. Price 21s. net.

In this volume the author has undertaken to provide an outline exposition of the application of scientific principles to the whole art of electro-communication which will serve as an introduction to the specialised manuals on these subjects. A distinct gap is recognised to exist between the elementary type of text-book, which is chiefly concerned with the exposition of the first principles of magnetism and electricity in their practical application to telegraphy and telephony, and the more advanced works on the various branches of these subjects. The book is divided into fourteen chapters dealing successively with: simple apparatus and systems; short lines; transients; long lines; high speed apparatus and systems; alternating quantities; speech apparatus; line transmission; telephonic valves; signalling and switching; electromagnetic waves; high-frequeny circuits; production of transmitting currents; reception; these being followed by an extensive appendix. It will thus be seen that the treatment of the subjects has been so designed that the book will meet the requirements of university or technical college students as well as provide a text-book for those who desire to prepare for the final B.Sc. (Eng.) examination of the London University, the higher grade examinations of the C. and G.I., the entrance examination of the I.E.E., and the examinations of the Civil Service Commissioners.

The author has necessarily been obliged to discriminate between the various systems of telegraphy, and has restricted himself to those only which are likely to conform to examination requirements; but it is not quite apparent why the central-battery duplex system should be omitted while space is given to double plate sounder working, since the latter is now very much obsolescent; nor is it equally apparent why, particularly in conjunction with the "B kick" in quadruplex increment working, no mention is made of the "decrement" system. The "shunted condenser" is investigated mathematically in the chapter on transients, and the well-known relationship $L=KR^2$ obtained—a result which, of course, is never obtained in practice because of the number of variables that enter into the problem. The mathematical demonstration for the theoretical duplex balance given in the appendix will be of interest to those practical engineers who, by empirical methods of their own, obtain balances of extraordinary accuracy. No mention is made of that important quantity the "time-constant" and, although it is implicitly involved in the Helmholtz equation on page 62, it is not explicitly evaluated.

The sections dealing with telephony and line transmission provide the student not merely with the practical aspects of these subjects, but also furnish him with the mathematical investigations by which he should be guided. The final section on wireless is up-to-date and gives an excellent exposition of the latest developments in this particular sphere. The student, however, will not find this book to be one that can be read easily through unless he possesses a good grounding in mathematics, as the author makes constant use of hyperbolic and exponential functions, in addition to the calculus, throughout the entire work. But, given this preliminary requisite, he will be in a position to appreciate the various proofs, step by step, as they are developed throughout the text.

The book is one that more than fulfils the author's modest claim for it, and can be unhesitatingly recommended to those students preparing for the higher examinations in the subjects, as also to those who read the work with the object of specialising in one or other of its branches. The book is excellently printed, and the diagrams are numerous and clearly reproduced.

Theory and Design of Electrical Machines. By F. CREEDY, M.I.E.E., A.C.G.I. Pp. xvi+349; figs. 228. London: Sir Isaac Pitman & Sons, Ltd. Price 30s. net.

"The present treatise represents an effort to reduce the study of the dynamo-electric machine to a scientific form, and to introduce order where, owing to the enormously rapid rate of development, there is little sign of it at present," says the author in his preface. But even Mr. Creedy's genius can scarcely succeed completely in producing order out of chaos. There still remains much for the earnest and enthusiastic plodder, when genius has shown the way. The matter and methods indicated in this book are novel, interesting, and undoubtedly logical, but they leave a too incoherent purview of the wide field covered. Many readers would find the treatment too difficult without an interpreter. The aim of the book is first of all to present the action of electrical machines in a general form—a kind of "electric mechanism"—and to derive the possible commutations and permutations of types, with indications of their possibilities and limitations. In this way, the author surmises, "the development of electrical apparatus might be reduced to a scientific form instead of being left to the haphazard efforts of individual inventors, the success of which is determined by natural selection." In the first part of the book the fundamental equations of the author's system are developed, as a special case of Maxwell's general equations of the electro-magnetic field, and the problems of classification are then dealt with. The idiom used is unusual to the electrical engineer, and the theme is sometimes very difficult to follow. Furthermore, the classification resolves itself into a rather unusual array of types, namely: (1) fundamental types without commutator or variable pole-pitch; (2) commutator motors operating on constant frequency supply; (3) machines operating from variable and multiple frequency generators; (4) cascade sets; (5) multiple-polarity machines; (6) variable-polarity apparatus. That the author has a deep sympathy for, and a wide knowledge of, variable-pole induction machines is clear from the space devoted to these types in the latter part of the book and from his earlier work in this connection. Finally, a universal method of design is given, involving the use of a calculating machine, which will almost feed out a design at one end if supplied with a specification at the other. The equations aim at developing universal expressions applicable to the calculation of any machine, the designer requiring only to apply the necessary empirical data (*e.g.*, space factor in slots) to obtain a solution.

tI is difficult to make an adequate criticism of the book. While it contains a great deal of provocative matter, it may be that the author is a pioneer of what in a few years will be a commonplace. To the advanced student and designer there is much to create thought along distinctly new lines, well deserving of consideration. The advantages of a general survey of the theoretical possibilities cannot be denied, for much time and money in developing unsuitable types may thereby be spared. The treatise Mr. Creedy has given us is clearly the result of years of prodigious labour, and we hope his pioneer work will inspire thinkers both here and abroad.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

A New Current Detector.

A special heat-sensitive mixture which changes from a pale-yellow to a bright-red colour at 100 deg. F. is the secret of a recently-designed current detector. The apparatus consists of a cylindrical metal tube with two contact points similar to those of an electric lamp at one end and sealed at the other end. On one side of the cylinder is a rectangular opening fitted with a mica window, and under the mica is a strip of paper with the word "alive" painted on in the heat-sensitive mixture. Inside the cylinder is a tiny heating element of such ohmic resistance as to require a negligible amount of current to produce the moderate rise in temperature required. On inserting the instrument into a lampholder the element is heated, so causing the lettering to stand out in bright red if the circuit is alive. The lettering remains red for several moments, so that the instrument may be taken from the lampholder into the light, should the room be dark or the holder not easily accessible. The instrument is quite small, weighs only a few ounces, and can be slipped into the pocket without fear of damage. This detector is not yet on the market, as its inventor, Mr. R. Collier, of 1, Elm Park Road, South Norwood, London, has not yet arranged for its manufacture. It is hoped, however, that the device will be available shortly at a very moderate price.

Mercury Contactors.

Interesting claims are made for "Cutax" mercury switches, recently introduced by THE ELECTRICAL EQUIPMENT & CARBON CO., LTD., 107-111, New Oxford Street, London, W.C.1. With the "Cutax" switch the break takes place in a hermetically-sealed chamber filled with a specially selected inert gas under pressure. The break always takes place between mercury and mercury, the heat of the spark being absorbed by the volatilisation of the mercury. A quartz annular sleeve acts as the insulating medium between the mercury poles of the switch. Any mercury which is volatilised by the arc condenses on the

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walls of the chamber, and returns to the sump as soon as the switch is again closed. Owing to the perfect contact which is obtained between the poles of the switch, the 32-A size may be used with perfect safety for closing circuits up to 600 A. This property is valuable in cases where the initial current is much greater than the normal current, as, for instance, in the case of starting up motors, metal-filament-lamp circuits, &c. The power taken by the operating coil is exceptionally low, being 5 watts for direct-current and 6 watts for alternating-current circuits. A particular advantage of the switches is that they take up only a small space. Further, the switch tubes can be supplied without the energising coil or case, enabling manufacturers to incorporate them within their standard equipments. A test on a No. 1 size tube was made over a period of two years, switching a 15-A metal-filament lamp circuit on and off. After operating approximately two million times the switch was dismantled and found to be in perfect condition.

A Novel Lighting-strip Lampholder.

The "Strombo" lighting-strip holder, fig. 1, an invention of Mr. A. E. Howard, 5, High Holborn, W.C.1, is designed

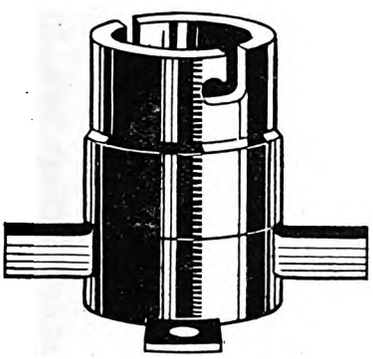

Fig. 1.—The "Strombo" Lampholder.

Fig. 2.—New "Standard" Cell.

for easy assembly on twin-core rubber-sheathed cables, giving a weatherproof connection without the use of insulating compound, &c. It is made in two parts of vulcanite or similar material. One part receives the lamp which can be an ordinary b.c. or s.c. lampholder with two sharp pins which penetrate the sheath and insulation of the cable and make contact with the cores. The second part or base accommodates the cable, and the two parts are held together by means of a common screw-on arrangement. An important point is that the holders can be obtained separately, *i.e.*, *without* the cable, so that contractors can make up their own lighting strip with any desirable spacing of the lampholders. Further, the holders are interchangeable, and the spacing can be altered to any distance required.

An Automatic Commutating Rectifier.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, is now supplying a new automatic commutating rectifier called the "Akk-Emmar." It embodies a new and improved method of converting alternating current into direct current, and is claimed to be less expensive and more efficient than driving a d.c. generator by means of an a.c. motor. The apparatus is a light, compact and self-contained outfit, particularly suitable for charging accumulators and for giving single-wave rectification for all non-induction circuits. Special features of the "Akk-Emmar" are the patent automatic polarity changer and the battery automatic cut-in and cut-out which make the operation of the rectifier entirely automatic.

The constructional details include a self-starting synchronous motor having mounted on its shaft extension an external combined commutator and slip-ring and brush gear for rectifying the alternating current, the whole, together with the switchboard, being mounted upon a substantial cast-iron baseplate. The apparatus is manufactured in two models Nos. 2 and 4; No. 2 (20 in. × 25 in. × 13 in.) is suitable for charging all types of accumulators, and No. 4 (26 in. × 26 in. × 13 in.) is specially designed for continuous duty in heavy garage work. They may be described as "fool-proof," requiring no technical knowledge to operate them, and a further feature of importance is that under no circumstances will any interference to wireless reception be caused by their use A model is also available for double-wave rectification for kinema accumulators, &c.

New "Standard Battery" Products.

We learn that the Standard Wet Battery Co., 184-188, Shaftesbury Avenue, W.C.2, has made further interesting improvements in the construction of its "Standard" wet Leclanché batteries for radio use. The new design takes the form of a cartridge consisting of the sac element or depolariser and zinc in one piece. The cartridge elements are inserted in the jars which have been filled to a certain mark with fluid, after which a tight fitting cork is pressed over the carbon rod and into the neck of the jar. Final assembling is carried out by placing the cells in rows in unibloc trays which hold 32 cells and snapping the zinc lugs, which have holes punched in them, over the brass cap of the carbon rods. The work of fixing up or replenishing parts of the battery is extremely simple, and the greatest economy is effected, due to the fact that only completely used up parts require replacements. Apart from the economy, the reception obtainable from these batteries is the best possible, owing to a total absence of background noises which are liable to occur, due to leakages between cells in the dry type of leclanche batteries. The No. 3 cartridge cells have a capacity of 10,000 mA. and the No. 4 cells of 20,000 mA.

The Standard Wet Battery Co., has also introduced a new three-in-one meter. This is portable and has been designed for panel mounting. To obtain the three readings of 0-150 volts, 0-6 volts and 0-30 mA. a neat bakelite plugging bridge is provided for fixing in the panel with three small plugs. Instructions for plugging-in are provided on an ivorine plate which is also attached to the panel, different coloured disks showing readily the required point, as detailed in the instructions.

Additional to this three-in-one meter, the company has also introduced a single-scale instrument reading 0-25 mA. for panel mounting and a similar model 0-50 mA.

Cartridge Fuses for Underground Work.

A new cartridge fuse, fig. 3, has recently been put on the market by Messrs. W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1, which provides a very satisfactory protective device against the effects of short-circuits and heavy overloads on distribution systems. These fuses operate at 2.6 times the working current within 30 minutes, whilst they are so designed that they will not blow with twice the working current. One great advantage of this new fuse is that, being interchangeable with the standard link fittings in "Henley" underground disconnecting boxes, it can be inserted, if desired, in existing installations where these boxes are used. The fuses are very robust and yet the requisite degree of strength has been achieved without making them unduly bulky. The fuse consists of a barrel-shaped cartridge with U-shaped brass spring contacts projecting at each end. The cartridge fuse is held in a specially designed fuse carrier

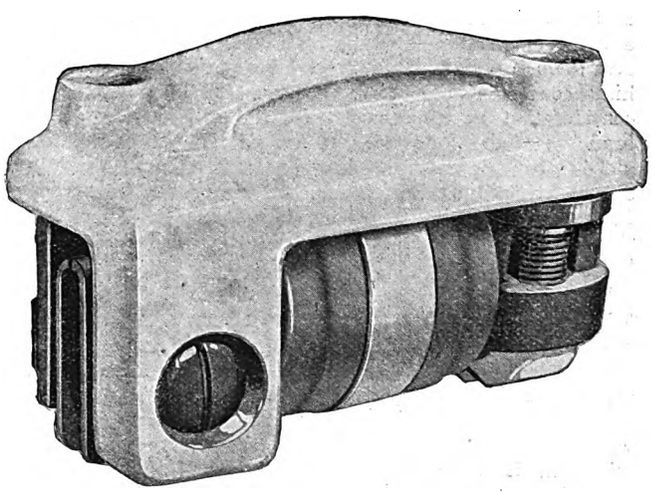

Fig. 3.—The "Henley" Cartridge Fuse.

by screws passing through the U-shaped contacts which also secure the wedge clamping device. It is a simple matter to fit a spare cartridge fuse to the porcelain carrier when a fuse has operated, there being no need to discard the porcelain carrier. In order to tighten the spring contacts, the wedge-shaped pieces are screwed down, using the insulated screwdriver which has been specially designed for this purpose. The arrangement ensures a rigid assembly and a thoroughly efficient contact. The range of sizes includes fuses for working currents from 60 to 300 A, and for use in disconnecting boxes taking up to 0.15 sq. in. and 0.30 sq. in. conductor cables. The fuses have been submitted to exhaustive tests by Henley's Research Laboratories and also by independent testing departments with successful results.

"Sindanyo" Insulating Board.

While "Sindanyo" insulating board is not new and is being extensively used, we feel that its characteristics and properties are not sufficiently widely known to justify the exclusion of the following particulars, which we have obtained from the makers, Messrs. Turner Bros. Asbestos Co., Ltd., Rochdale, from this section. Ebony "Sindanyo" insulating board was first produced to meet the growing need for a scientific product to replace natural materials and satisfy all the requirements of modern electrical engineering. The materials and processes used in its manufacture have been determined so that it might claim to possess properties which, in combination, render it superior to any natural products hitherto used for insulating purposes, although being saleable at a reasonable price. The material is manufactured from an asbestos base. Its electrical

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properties are illustrated by the following results of tests carried out by the National Physical Laboratory. Electric strength; r.m.s. volts per inch, 54,000 for 1-in. material and 79,000 for ½-in. material; surface breakdown; 25,000 V (r.m.s.) for all thicknesses. Some of the other factors which are claimed for ebony "Sindanyo" are:—Great resilience, facilitating the distribution and absorption of the impact of heavy modern switchgear, and permitting the use of thinner panels than is necessary in the case of slate or marble; great mechanical strength—tests carried out by the National Physical Laboratory on "Sindanyo" board show tensile strengths of 1,650 lb. per sq. in. (ultimate stress) for 1-in. material, and 2,205 lb. for ½-in. material; light weight, having a saving of about 50 per cent.; uniform thickness, being accurate to within .010 in.; good machining properties—the board can be cut and drilled much more easily than natural products; unfailingly reliable insulation, obviating the usual precautionary bushing of holes for leading through connections; ability to withstand heat, being unaffected by temperatures up to 160 deg. C.; and non-hygroscopic character, as indicated by the following National Physical Laboratory test results: water absorption, percentage increase in weight after 48 hours' immersion; 1-in. material 0.07, ½-in. material 0.06. The board is manufactured in standard sheets, 4 ft. by 3 ft., and in thicknesses ranging from ⅛ in. to 2 in. The manufacturers have also developed special plant for supplying switchboards, bases, and all manner of pieces cut to size, bevelled and enamelled, to meet the exact requirements of individual customers, and a large proportion of the sale of "Sindanyo" is actually effected in these finished forms. Three finishes are available, namely, standard, matt, and enamel. It is interesting to learn that "Sindanyo" insulating board has been accepted by Lloyd's Register of Shipping as an approved material for the panels of electrical installations of vessels classed with the Society, and it is employed by leading electrical manufacturers of this country and a considerable number of manufacturers all over the world. The makers have recently published a pictorial booklet which illustrates this fact in a convincing manner by showing photographs of "Sindanyo" insulating board as actually used on apparatus manufactured by a selection of some thirty firms.

Selling Time Switches.

Mr. E. E. Sharp Opens a Discussion at an E.D.A. Conference.

THE monthly Salesmanship Conference of the E.D.A., in London on November 15th, discussed the subject of selling time switches. Sir John R. Brooke (Electricity Commissioner) was in the chair.

Mr. E. E. Sharp opened the proceedings with a lecture, and as he is himself an experienced salesman, his remarks have a wider application than the restricted title would appear to give them, and he was able to give his audience many practical hints concerning the trade. His remarks may be worthy of consideration by all engaged on the selling side of other branches of the industry. As one who knows something of globe-trotting in search of business, it was inevitable that he should bring into his talk some of his overseas experiences. Moreover, although his primary object was to talk of selling time switches this actually occupied the smaller part of the lecture.

Having set out the salesman's attributes of initiative, knowledge of his subject, interest in the consumer, and enthusiasm, as the main qualities of a successful salesman—although he did not suggest that these completed the list—Mr. Sharp was severely critical of schools of salesmanship, the product of which he characterised as filing cabinets, and remarked that when discussing vacuum cleaners, for example, with such a salesman, it was almost possible to watch the index being worked through. On the subject of initiative, he told his audience how his company had a scheme for lending out a specialist salesman in time switches to central stations for a week at a time. This man canvassed the various shopkeepers and got them interested in shop-window lighting after closing hours, and the use of time switches in that connection, without mentioning the name of his own firm. Four weeks before the week's campaign started, an E.D.A. pamphlet dealing with shop-window lighting was sent round to a list of shopkeepers provided by the supply authority; three weeks before, another E.D.A. pamphlet was distributed; two weeks before, yet another; and a week before a letter was sent saying that the representative would call. Thus the ground was well prepared. The representative merely talked of the value of shop window lighting after opening hours, and as a result orders were invariably obtained. Thus the supply authority got additional load, the consumer got a good advertising device going, a contractor usually had to make some small alterations to the installation, E.L.M.A. sold more lamps, E.D.A. sold more "dope," the G.P.O. sold more stamps, and his own firm got an order for time switches.

As to knowledge of the subject, an interesting case was mentioned of an order in which his firm many years ago was underquoted to the extent of £750, and the case was regarded as so hopeless that it was not thought worth while sending a senior member of the firm to deal with the matter. Consequently, Mr. Sharp, then a junior member, was sent down to make a call just to keep in touch with the people. With youthful eagerness, he said, he made a minute study of his firm's and their competitors' instruments, and actually secured the contract after all, and he attributed this solely to his knowledge of the subject. Incidentally, he stressed the importance of knowing as much as possible about all the allied aspects of the particular article being sold, and as an instance mentioned that he tried to keep himself up to date in tariffs in relation to time switches. As a further example of this, he related a story of how when he was in Australia he gave a lecture to a number of engineers in which he described the methods upon which electricity was being developed in this country by the work of the Electricity Commissioners, and the Central Electricity Board and was positive that he received a good deal of business for time switches as a consequence of a display of knowledge which, he added, he might not have "got across" in this country.

Mr. Sharp was very outspoken in his comments as to the failure on the part of too many people actually engaged in the electrical industry to show that enthusiasm which they should do in the case of the greater use of electricity, and, he added, there were many gas engineers who were far more enthusiastic about electricity than were numbers of people actually engaged in the industry. They should not be afraid to use electricity in their homes for every purpose, even if it did cost a little more, if only for the reason that it would be helping the industry from which they drew their livelihood.

The lecturer expressed the view that initiative, knowledge of subject and enthusiasm, would frequently overcome lack of personality, and Mr. Sharp said he would rather have a salesman without a certain amount of personality, than one lacking in the other qualities. He considered that most of those engaged in the industry required a good deal more enthusiasm, courage, initiative and commonsense than had hitherto been evinced. One of the commonest uses of time switches was for shop-window lighting, but for the most part the work was bungled for lack of the virtues he had enumerated. A case was mentioned of a large stores in the district where the speaker lives, where there was some trouble with the time switch. When he went there personally he found the supply company had fixed the switch low down in a cupboard and it was necessary to grovel on the floor to get at it. It was one of the cheapest possible types, quite out of keeping with the size of the installation, and it was connected without a hand switch so that the window lights could not be switched on during the daytime in case of fog or darkness. No instructions had been given as to winding and setting and no key had been left for winding the clock. Moreover, the idea of fitting a time switch had come from the consumer and not the supply company. In the end, Mr. Sharp was able to arrange for the installation of a much better time switch.

There should be no timidity about price; the endeavour should be to carry the customer on a wave of enthusiasm. Just think, he said, of a clock that not only wound itself year in and year out but also changed the time of switching each day so as to follow the sunset time in the district in which it was fixed! All the new telephone kiosks were fitted with such time switches so that it would not be far to take a customer to show him one. Reference was made to the many other uses of time switches, such as for hall lighting when the consumer was out, for operating a buzzer on factory premises at meal times, &c., and in connection with all these it was urged that the salesman should not be obsessed by low price. Incidentally, a case was mentioned in which his firm's price was double that of a competitor, but yet he got the order after a discussion with the engineer concerned and a demonstration of the advantages of his time switch. Incidentally, he mentioned that in one town in New Zealand 7,000 time switches had been installed for water heating purposes during "off-peak" hours and that these were now being connected at the rate of 50 per week.

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Discussion.

In opening the ensuing discussion, Mr. V. W. DALE differed from Mr. Sharp with regard to schools of salesmanship, and suggested that there was plenty of room for the school to take in hand those who were born salesmen. In calling attention to any absence of mention by Mr. Sharp of saleswomen, Mr. Dale drew attention to the lack of facilities for teaching women for the sales side of the industry and expressed the hope that the speaker would be able to organise some such facilities. Finally, remarking that he, personally, always made it a habit to add a new piece of electrical apparatus in his house every Christmas. Mr. Dale said that if every one engaged in the electrical industry promised himself a new piece of apparatus every year it would mean a tremendous fillip to the industry all round.

Mr. HAYES asked Mr. Sharp for information as to how to get into the busy retailer or the buyer of a large stores when probably numbers of other salesmen had been trying to get in, and the telephone was ringing, while a customer was also waiting to be seen! Perhaps one difficulty in selling time switches was that the average electrical salesman had to handle so many items that he concentrated on those that were the most easily sold. It might be that we should develop towards specialist salesmen in time. Indeed, he thought he could see a movement in that direction.

Mr. H. W. WATTS (Epsom) expressed the view that the time switch would help a great deal during the next few years in enabling station engineers to cope with the maximum load. He was hoping to get a bulk supply by December, when he would be able to go ahead with water heating and other purposes for which time switches would be required.

Lieut.-Col W. A. VIGNOLES (Director and Secretary, E.D.A.) remarked that it was not those who attended these conferences that needed to be gingered up, and how to get at those who did not attend, he hardly knew. It must be remembered that their competitors had enormous enthusiasm, from the highest man in their industry to the lowest, notwithstanding that they were selling an inferior commodity to electricity. They realised the importance of salesmanship and everybody in the electrical industry must do the same.

Mr. HAZLETT asked for more information as to the large number of water heaters being installed in New Zealand, as mentioned by Mr. Sharp. There was a distinct demand here for such apparatus, on hire, but it had to be put in at the lowest possible cost and perhaps Mr. Sharp could evolve some apparatus for the purpose.

Mr. H. T. YOUNG contended that although there were some salesmanship schools which could not be recommended there were some where a salesman could learn a very great deal. As to vacuum cleaner salesmen, who had been mentioned, it must be remembered that what often happened in this respect was due to the system of the particular firm and not to the individual. These firms seldom did other than pay the salesman a straight commission without salary or anything else and that was not the way to build up good-will. He suggested that E.D.A. might do something in the direction of keeping a watch on the salesmanship schools that could be recommended.

Miss READING mentioned that the City of London Electric Lighting Co. had put in numerous time switches in City offices in connection with low-temperature heating installations.

The CHAIRMAN remarked that he had never noticed the apathy and cynicism suggested by Mr. Sharp among those who visited the Commissioners. There was, however, a danger on the part of many connected with the industry of assuming that the future lay with electricity without any shadow of doubt, and that they therefore need not trouble very much and could just wait for the world to come up to it. That was a mistake, and from that point of view there was a lack of enthusiasm for convincing outsiders of the value of electrical service.

Mr. SHARP, replying to the discussion, said he was glad to hear there were some good schools of salesmanship, and probably one day he would see one of their products who could convince him, but up to the present he had not. Water heating was an enormous thing for the electrical industry, and as regarded the New Zealand installations, he would give that information privately; it would take some time. The cost of the time switch was only about one-third of a penny per day including capital cost and maintenance, so that it was not a vital item. He doubted whether the industry really appreciated the possibilities of business in time switches. His firm employed 500 people and had up-to-date automatic plant, and the expansion of the business seemed to be purely a question of how fast the firm could grow. He again emphasised the necessity of not being afraid of the low prices of competing makes. Time switches would come into the tariff question very much more in the future, and he saw nothing at all to recommend the maximum-demand system as against the two-rate system.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

Personal Salesmanship.

Mr. Walter Buchler writes us on this question as follows:—

"When a principal of a firm or any representative from head office makes a trip overseas, his visit generally leads to extra business coming in. The same policy could well be applied to a greater extent than it is at present in the home markets. Salesmanship is getting better and better, but still the influence of a personal visit from one of the principals invariably creates a better understanding between customers and suppliers, and leads to more orders; at least, that is my experience here and abroad."

This point has been so often referred to that we think that there can be few firms or companies in the electrical industry and trade who fail to appreciate its importance. Many principals of small firms are constantly on the travel, and managing and other directors of big concerns do the same. But principals and directors have other duties and reponsibilities which must be performed if they are to take a live interest in their undertakings. Every important man, whether he travels abroad occasionally to give the business the benefit of his personality, or whether he takes an occasional run round at home, needs an efficient substitute or substitutes; but apart from this aspect of the question there is the crying need for improving the qualifications, status and remuneration of the salesman himself. The report of Government Committee on Education for Salesmanship will shortly appear. Mr. F. W. Goodenough in an address at Birmingham last week said that we needed as a nation a better appreciation of the importance of salesmanship in the high places of the industrial world. To that end there must be suitable education available. The committee which was appointed in October of last year by the President of the Board of Education, includes Mr. P. J. Pybus, Sir G. C. Vyle, and Col. the Hon. Vernon Willey (with Mr. Goodenough as chairman). Its duty is to make recommendations upon the problem of education for salesmanship, and we await its report with interest. We believe with our correspondent that salesmanship is improving, and we appreciate, as we have frequently said, the wisdom of principals or chiefs or men of a special type of personality and qualification suited to their potential customers, going into both the foreign and the home markets supplementing the work of their own salesmen or travellers. We expressed our editorial views on this subject in an article on "Salesmanship Abroad" in the ELECTRICAL REVIEW for October 5th, 1928, an article which those interested in the subject might find it well to re-read at the present time.

The Federation of British Industries and the Effects of Wall Street Panic.

We have received the following notes from the Federation of British Industries since our leading article in this issue was written:—

"The F.B.I. Business Forecast for the Fourth Quarter of 1929, which was written before the Wall Street panic, foreshadowed not only a break in U.S. Stock Exchange securities, but also a major recession in trade, centred in the U.S.A.

"The sudden and dramatic confirmation which the first part of the forecast received, while still in the printers' hands, has

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resulted in its second and more important implication being largely overlooked. It is necessary to make clear that the trade recession to which the F.B.I. look forward is something more serious than a mere contraction of luxury expenditure resulting from direct losses in the Stock Exchange slump itself. Their forecast is based on the view that a substantial part of U.S. prosperity during the past two or three years has been built up on an unstable basis due to the inflation of individual expenditure and the general standard of living to a level much above that justified by the *actual* earnings of American citizens. This artificial inflation of expenditure has been made possible by two circumstances :—

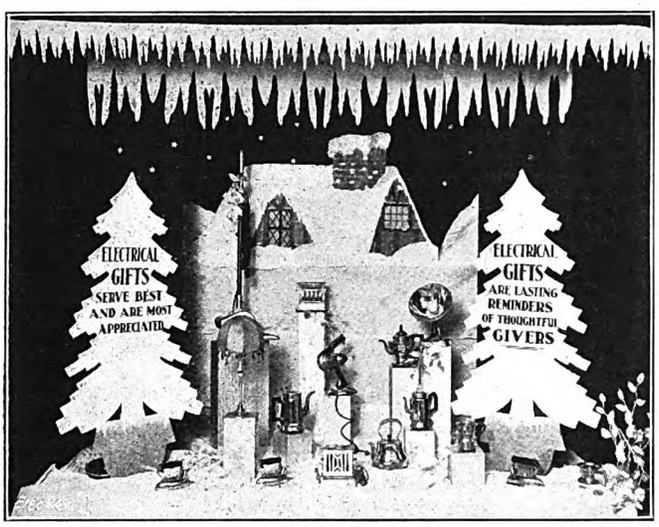
"1. The instalment system which has enabled individuals to mortgage their incomes in advance of earnings.

"2. The expenditure on current consumption of sums made by Stock Exchange speculation, a process which may not unfairly be described as the spending as income of funds which should properly have been devoted to increasing the capital equipment and resources of the U.S.A. and the rest of the world.

"In this respect the present crisis differs markedly from those which occurred in similar periods of 'trade cycle' culmination before the war, which were generally brought about by the converse process, viz., an undue diversion of current income to capital projects. Failure to appreciate this difference is largely responsible for the misunderstanding which appears to prevail regarding the probable industrial consequences of the present movement."

Christmas Window Displays.

The main feature of the December programme of the British Electrical Development Association is a series of Christmas window displays, two of which are illustrated herewith. The designs have been kept as simple as possible in order to make it practicable for the smallest showroom to adopt them. Dressing aids for window displays, and a lantern slide of an advertisement of electrical Christmas gifts are available for retailers; also a complete stereo of the advertisement, pierced for the inclusion of the advertiser's name, for use in local press advertisements. The advertising campaign in national newspapers will be devoted mainly to ideas for Christmas gifts, while large displayed "electric homes" advertisements will appear in London and provincial newspapers and leading home journals. A number of seasonal E.D.A. publications are listed in the programme.



Two E.D.A. Christmas Window Displays.

Registered Electrical Contractors.

Applications for registration from the following were accepted by the Executive Committee of the National Register of Electrical Installation Contractors at its last meeting :—

Boyces, Nelson, Lancs.
Mortimer & Gall, London, E.C.2.
Watkins & Richardson, Norbury, S.W.16.
Peacock, Robert, Junr., & Co., Mount Florida, Glasgow.
Raistrick, L., Bradford.
Day, G. W., & Co., Westminster, S.W.1.
Ritchie, A., Glasgow.
Noble, H., Lakenham, Norwich.
Barker & Wilkinson, Harrogate.
Rickards, Charles, Ltd., Paddington, W.2.
Hubbard & Williams, Newton Heath, Manchester.
Ashton, E. R., Heaton Moor, Stockport.
Leek, R. W., & Co., Newcastle-on-Tyne.
Allom Bros., Ltd., Hanover Square, W.1.

At the same meeting ten applications were declined.

Polish Foreign Electrical Trade.

During September last the imports into Poland of "conductors, apparatus and other electro-technical materials" were valued at 8,464,000 zloty (£194,000), while exports of the same class had a value of 84,000 zloty (£1,930).

The Next Imperial Conference.

In view of the forthcoming Imperial Conference in 1930, an arrangement has been come to between the Association of British Chambers of Commerce, the Federation of British Industries and the Chamber of Shipping of the United Kingdom, representing the commercial, industrial and shipping interests of this country, to form a British Preparatory Committee to consider the general question of Empire commercial policy, with the object of co-ordinating as far as possible the views of the business community of the United Kingdom and of presenting to the Government joint recommendations on all questions upon which unanimity of opinion can be obtained.

Contractors' Dance in Aid of the E.T.B.I.

The Birmingham Branch of the Electrical Contractors' Association is holding a dance at Tony's Ballroom, Hurst Street, on November 29th (8 p.m. to midnight), in aid of the E.T.B.I. Tickets (2s. 6d. each) can be obtained from Mr. S. Dagnall (S. Dagnall, Ltd.), 420, Stratford Road, Sparkhill, Birmingham.

Japanese Machinery Import Schemes.

It is reported from Yokohama that certain interests engaged for many years in the importation of German machinery into Japan have prepared a scheme for the direct importation of foreign machinery. This plan proposes to by-pass the foreign agents in Japan whose commissions are said to be high, and to open in the countries concerned Japanese agencies which would deal with the principals.

It is also learned from the same source that Mr. I. Yamanaka, president of the Yamanaka Bank, Tokio, plans the establishment of a company, with a capital of 3,000,000 yen, for the purpose of importing German machines. He is said to have the support of Mr. T. Harada, director of Messrs. Takata & Co., who holds agencies for many German manufacturers.

The German Insulated Wire Industry.

It is estimated that about 50 works in Germany are now engaged in the production of wire conductors, or twice the pre-war number. Competition is keen in the home market, and prices are depressed, while the export trade is difficult. In 1913 Germany exported 20,000 tons of copper wire and about 9,000 tons of covered wire, but in 1928 only 8,400 tons of copper wire were exported. During the current year, however, an improvement has taken place, as up to the end of September 8,800 tons of copper wire were sent out of the country, as well as 10,300 tons of covered wire, the latter comparing with 11,000 tons during the whole of 1928.

Illumination Design Course.

The fourth lecture of the 20th Illumination Design Course took place on November 11th, when Mr. S. Anderson gave a talk on industrial lighting. Amongst other things, the lecturer pointed out the necessity for the avoidance of glare, both direct and indirect, and of hard shadows, whilst the question of maintenance was considered. Sixty members of the electrical trade were present. The fifth lecture took place on November 18th, when Mr. H. Lingard dealt with the question of floodlighting.

Electrical Trades' Commercial Travellers' Association.

The second annual dinner-dance of the Electrical Trades' Commercial Travellers' Association is to be held at the Hotel Cecil, Strand, W.C., on December 11th, when Mr. R. W. Whitley, who has succeeded Mr. J. W. Ward as chairman of the Association, will preside. The price of the tickets is 12s. 6d. each, and these can be obtained from Mr. Ward or any member of the committee.

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New Catalogues and Lists.

Watson & Sons (Electro-Medical), Ltd., Sunic House, 43-47, Parker Street, Kingsway, W.C.2.—A well-produced brochure dealing in an interesting manner with high-tension transformers for X-ray work. Some excellent illustrations of the company's products are included.

Messrs. L. G. Hawkins & Co., Ltd., 30/35, Drury Lane, W.C.1.—A sheet showing a selection of the company's products, enclosed in a folder giving particulars of the "Universal 50-50" way of assisting dealers in local advertising.

Edison Swan Electric Co., Ltd., 1a, Newman Street, Oxford Street, W.1.—A booklet containing information regarding appropriate lighting of churches. Many illustrated examples of B.T.H. installations are included.

David Brown & Sons (Huddersfield), Ltd., Park Works, Lockwood, Huddersfield.—A number of illustrated publications giving a full description of various standard types of worm reducing gears.

The Burlton Institute (Miss Gladys Burlton), 30, Manchester Street, London, W.1, supplies a series of fifty bulletins (100 words each) for weekly distribution among selling staffs. A wooden frame is supplied to hold them. A specimen received is entitled "Little Fish are Sweet."

Messrs. J. A. Crabtree & Co., Ltd., Lincoln Works, Walsall.—The latest issue of *The Crabtree* contains, in addition to notes on the company's products, a delightful article by Mr. Crabtree, entitled "Three Memories."

Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, S.W.1.—A November stock list of the company's products.

Korting & Mathiesen Electrical, Ltd., 711 & 715, Fulham Road, S.W.6.—Four new lists, dealing with "Kandem" desk lighting fittings and other local lighting units, lowering gear for lanterns, &c., "Pilolite" fittings for use in hospitals, &c., and "Farlite" lanterns for exterior lighting, &c.

Messrs. Arthur Lyon & Co., 14, Queen Victoria Street, E.C.—An illustrated brochure describing synchronised electric clocks. Priced.

Wholesale Fittings Co., Ltd., 23, 25, 27 & 37, Commercial Street, E.1.—An illustrated catalogue of electric fires, including dimensions and prices.

Wardle Engineering Co., Ltd., Elsinore Road, Old Trafford, Manchester.—A brochure containing descriptive particulars of "Prismat" bulkhead fittings. Illustrated and priced.

"M.K." Electric, Ltd., Wakefield Street, Edmonton, N.18.—A new comprehensive catalogue (pp. 71) of the company's electrical accessories, including illustrations, dimensions and prices.

Messrs. Philip S. Schulman, Ltd., "Philora" Works, 76 and 78, Victoria Road, Dickenson Road, Manchester.—A catalogue, illustrated in colour, of the company's wide range of "Philora" lamp shades. Priced.

Sun Electrical Co., Ltd., 118-120, Charing Cross Road, W.C.2.—The catalogue for the season 1929-30 of wireless receivers and components is again a very comprehensive one. It has been considerably enlarged (pp. 224), and contains brief particulars, prices and illustrations of all classes of makes. In addition to the table of contents, reference to any particular component is facilitated by a very complete index.

Cryselco, Ltd., Kempston Works, Bedford.—A catalogue containing prices and illustrations of Cryselco lamps, and some views of the company's works.

A.E.G. Electric Co., 131, Victoria Street, S.W.1.—A London stock list of a.c. and d.c. motors, "Furniculus" fires, domestic appliances, &c.

33,000-Volt Cable for Sydney.

On November 3rd five huge drums were taken from the Enfield Cable Works, Ltd., Brimsdown, by the London and North-Eastern Railway to King George V Dock for shipment, per s.s. *Ferndale*, to Sydney. These drums each contain 700 yd. of 3 by .25 sq. in. paper-insulated, separately lead-sheathed cables, laid up, double wire armoured and served, of the 33,000 volts super-tension type. Each drum weighs 28 tons 1 cwt., and is 11 ft. in diameter. It is claimed that these are the heaviest lengths of cable ever made in Great Britain; they will be laid across Sydney Harbour. A special train was required for the transport by rail of these drums, which consisted of five trucks, suitable for heavy machinery, and engine and brake van. Traffic on the down line was suspended while the train made the journey from the factory at Brimsdown.

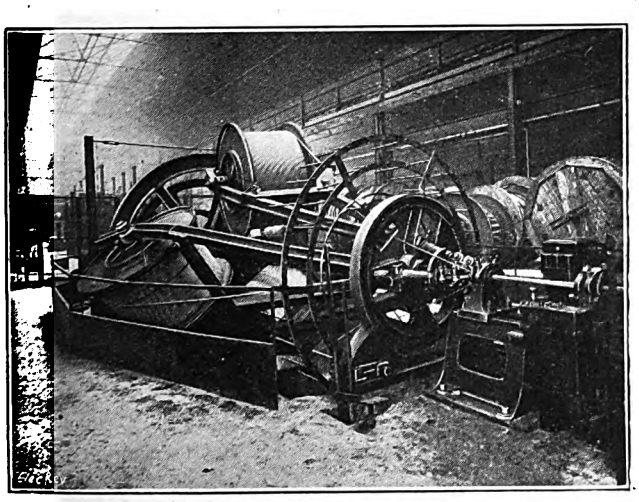

Fig. 1.—Laying-up Machine Used in the Manufacture of .25 sq. in. Cable for Sydney Harbour.

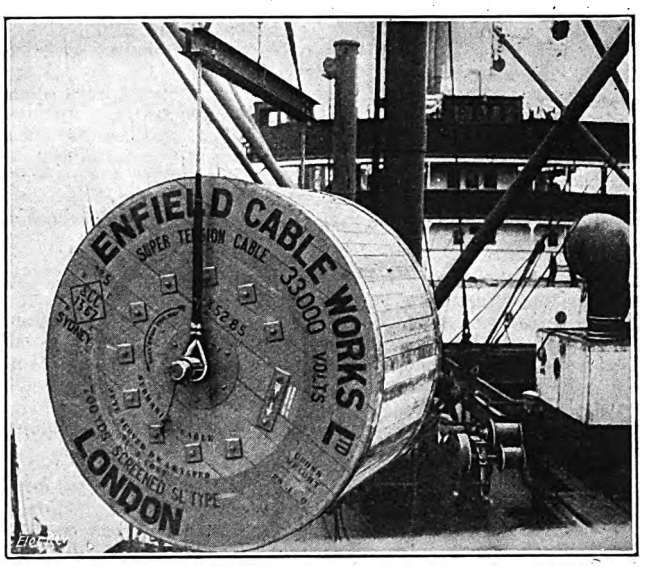

Fig. 2.—Shipping the Sydney Cable.

Trade Announcements.

Mr. Alexander Auld has started business as an electrical engineer and contractor at Wellington House, Alloway Place, Ayr.

Messrs. Lockhart & Macnab, electricians, of Stirling, have transferred their electrical fittings and wireless departments from 3, Murray Place, to 34-38, Craigs, where a new showroom has been provided.

The Arrow Electric Division, of Hartford, Connecticut, U.S.A., manufacturers of reciprocating heater switches and general wiring devices, has recently moved to new offices and showrooms at 79, Great Queen Street, Kingsway, London, W.C.2, where it has a stock of switches for the British and West European markets.

Recent Contracts.

Among orders for "Mirrlees-Diesel" engines recently received by Messrs. Mirrlees, Bickerton & Day, Ltd., are the following:—The Dabhoi (India) Electricity Supply Co., Ltd., has ordered a two-cylinder, 100-b.h.p. engine, in addition to one of 150-b.h.p. already installed. Callender's Cable and Construction Co., Ltd., has ordered two three-cylinder, 165-b.h.p. engines for the Shiraz (Persia) power station. The Panama Corporation, Ltd., is being supplied with three six-cylinder, 450-b.h.p. engines directly coupled to "G.E.C." alternators. An order has also been received for, *inter alia*, two three-cylinder, 75-b.h.p. engines directly coupled to 50-kW "Brush" generators, for the Montevideo Waterworks Co.

Book Notices.

"*Journal* of the Institution of Electrical Engineers." Vol. LXVII. November, 1929. No. 325, and Index to Vol. LXVII. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

"Ralph Stranger's Wireless Library," No. 1, Matter and Energy; No. 2, Electrified Matter; No. 3, Electronic Currents; No. 4, Magnetism and Electro Magnetism; No. 5, The Mathematics of Wireless; No. 6, Batteries and Accumulators. London: George Newnes, Ltd. Price 1s. each.

"Radio Traffic Manual and Operating Regulations," by R. L. Duncan and C. E. Drew. Pp. ix+187; figs. 16. Price 10s. net; "Elements of Radio Communication," by J. H. Morecroft. Pp. x+269; figs. 170. 15s. net; "Electric Street Lighting," by C. J. Stahl. Pp. xi+228; figs. 128. Price 17s. 6d. net. London: Chapman & Hall, Ltd.

Electrical Propaganda at Eastbourne.

The fortnightly meetings held at Eastbourne Corporation Electricity Department's showrooms, at which lectures on the uses of electricity are given, are proving very popular and are attended by between 60 and 100 people. The last three speakers were Mr. H. Lingard, on "Improved Lighting in Workshops"; Mr. V. W. Dale, on "Cooker Construction" and "Taking Greater Advantage of Electrical Appliances"; and Miss C. Haslett, on "Electricity in the Home." The chair is usually taken by Mr. J. K. Brydges, the borough electrical engineer, and we are informed by Mr. F. A. Dracup, the sales manager, that considerable progress has been noted in the hire of cookers and appliances since this series of lectures commenced.

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Bankruptcy Proceedings.

WALTER ADAMS, 50, Lee Park, Blackheath, Kent, radio dealer and sign maker.—The first meeting of the creditors was held on November 12th at 29, Russell Square, London, W.C.1. According to the statement of affairs submitted, there were liabilities amounting to £178 against assets of £16. Debtor attributed his failure to lack of capital, ill-health, and bad trade. He stated that in August, 1928, with £25 capital and £75 borrowed money, still owing, he commenced business as a sign maker at 18, Church Street, Greenwich. The business was not successful, and in December, 1928, he discontinued it and commenced business as a radio dealer at the same address. This also was not successful, and in June, 1929, he closed it down. He stated that he had not kept any books of account. The case was left in the hands of the Official Receiver as trustee of the estate.

E. H. NEWMAN and N. BAYNES, trading as Langham Radio, wireless manufacturers, 96, Regent Street, W.—The adjourned first meeting of creditors was held last week at the London Bankruptcy Court. Particulars of the failure appeared in our last issue. The Official Receiver reported that the meeting had stood adjourned with a view to the appointment of a trustee, but no nomination had been received. No resolution was passed, and the estate was left in the hands of the Official Receiver.

JOSEPH CAMEROFF, 147, Spencer Place, Leeds, electrical engineer.—The public examination was held on November 12th at the County Court House, Albion Place, Leeds, when a statement of affairs was returned showing liabilities of £351 and a deficiency of £335. The debtor ascribed his failure to lack of capital and loss on contracts. The matter was formally adjourned.

FREDERICK HENRY GRAHAM, 14, Hilltop Avenue, Harehills, Leeds, electrician.—The public examination of this debtor was held on November 12th at the County Court House, Albion Place, Leeds, when the failure was attributed to ill-health and lack of capital. The debtor produced a statement of affairs showing liabilities of £245 and a deficiency of £20. The hearing was formally adjourned.

E. E. PEACE (Peace & Co.), manufacturing electrical engineers, rear of 230, High Street, Erdington, Birmingham.—Receiving order made November 12th on debtor's own petition.

V. H. BATES (Linton Radio Service), wireless engineer, High Street, Linton, Cambs.—Receiving order made November 11th on debtor's own petition. First meeting November 23rd, at the Official Receiver's office, 41, Sidney Street, Cambridge; public examination December 4th, at the Guildhall, Cambridge.

F. G. WHEELER, electrical engineer, Wychwood, Broadlands Avenue, Shepperton-on-Thames.—Bankrupt's discharge suspended for eighteen months.

S. E. HUNT, electrical engineer and contractor, 8a, Torwood Street, Torquay.—Last day for proofs for dividend, November 29th. Trustee, Mr. E. H. Hawkins, 4, Charterhouse Square, E.C.

D. BRAYSHAW, electrician, 78, Granby Street, Liverpool.—First and final dividend of 4s. 7½d. in the £, payable at the offices of the Official Receiver, Government Buildings, Victoria Street, Liverpool.

L. W. WESTBURY (L. W. Westbury & Co., & Walsall Radio Co.), wireless goods dealer, 146, Lichfield Street, Walsall.—First meeting held November 20th at the Official Receiver's Office, 30, Lichfield Street, Wolverhampton; public examination December 12th at the Court House, Walsall.

H. HOLMES, electrical contractor, plumber, &c., 60, Wards-End, Loughborough.—Application for discharge to be heard on December 4th, at the Castle, Leicester.

R. HORSFALL (Harrison & Horsfall), electrical engineer, Midland Street, Barnsley.— First and final dividend of 4s. in the £, payable at Standard Buildings, City Square, Leeds.

Company Liquidations.

BRITISH ELECTRICAL REPRODUCTION CO., LTD., Lee Valley Road, Ponders End, Middlesex.—A meeting of the creditors was held on November 12th at the offices of Messrs. Whinney, Smith & Whinney, C.A., 4b. Frederick's Place, E.C., when Mr. R. L. Latimer, the liquidator of the company, submitted a statement of affairs which disclosed liabilities of £4,367, of which £2,804 was due to the trade; and there was a sum of £1,285 due to the directors for advances. In addition, there were debentures and interest amounting to £539. They constituted a floating charge on the assets of the company which were estimated to realise £260, leaving the debenture holder an unsecured creditor for £277. There was a deficiency, therefore, as regards the unsecured creditors of £4,367. The liquidator pointed out that the debenture holder was willing to distribute any proceeds he might receive under his debenture to the trade creditors. The voluntary liquidation was confirmed.

BURGLASS & JAMIESON, LTD., Dundee.—What is believed to have been the first appointment of liquidator in Scotland under the new Companies Act, so far as the electrical trade is concerned, was made on November 6th, when Mr. H. C. McMillan (of Messrs. McMillan & Henderson, accountants, 13, Dundas Street, Glasgow) was appointed liquidator by the above company. The appointment has been confirmed by the creditors. The statement of affairs showed liabilities of £1,918 and net assets of £686, leaving a deficiency of £1,232. The following were appointed a committee of inspection:—Messrs. J. F. Irvine (J. F. Irvine & Co., Ltd.), Paterson (General Electric Co., Ltd.), and Duncan (Wood & Cairns, Ltd.). Messrs. McMillan & Henderson are the secretaries of the Scottish Electrical Manufacturers' and Factors' Association and the British Electrical Trade Protection Association.

UNIVERSAL & GENERAL RADIO, CO., LTD., Bravington Road, W.—A meeting of creditors was held on November 11th at the offices of the liquidator, Mr. H. N. Murray, 7-8, Poultry, E.C. The statement of affairs showed ranking liabilities of £33,152 and net assets of £6,713, leaving a deficiency, so far as the creditors were concerned, of £26,439. It was stated that the preferential claims were heavy, as they included a substantial amount for rent and a claim for income tax. No resolutions were passed, and therefore the voluntary liquidation of the company will be continued, with Mr. Murray as liquidator.

ELECTROMOTORS, LTD.—A meeting of members is called for December 18th, at the offices of Messrs. Addleshaw, Sons and Latham, 15, Norfolk Street, Manchester, to hear an account of the winding up from the liquidator, Mr. F. S. Abbott. (It will be well known to our readers that this company has been amalgamated with Laurence Scott & Co., Ltd.)

ACCUMULATORS OF WOKING, LTD.—A meeting of members is called for December 17th at the offices of Messrs. Tansley Witt and Co., 5, Chancery Lane, W.C., to hear an account of the winding up from the liquidator, Mr. H. Tansley Witt.

SOUTHEND RADIO GRAMOPHONE CO., LTD.—By order of the High Court, Mr. C. Latham, 78, New Oxford Street, W.C., has been appointed Liquidator in the place of Mr. T. L. Summers.

Dissolution of Partnership.

VAN RAALTE & MURREY, dealers in antiques, crystal fittings and electrical sundries, 1, Gilbert House, Princeton Street, Holborn, W.C.—Mr. H A. J. H. Murrey and Mr. L. Van Raalte have dissolved partnership. Mr. Murrey will attend to debts.

Private Arrangements.

JAMES WILLIAM ABBOTT, trading as Electrical Engineering and Supply Co., electrical engineer, 26, The Bank, Barnard Castle, Durham.—The creditors interested were called together recently, when a statement of affairs was submitted which showed liabilities of £580 and net assets of £322. It was stated that the debtor had recently suffered from ill-health, and a deed of assignment had already been executed in favour of Mr. H. Wood, C.A., of Newgate, Barnard Castle. The creditors decided to confirm the deed, and expressed the opinion that the trustee should continue the business for a period of six months, which would cover the busy season, and would also give him an opportunity of selling as a going concern.

Deed of Assignment.

A. D. ELLIOTT (deceased), hardware dealer and electrical engineer, 7, Washwood Heath Road and 15, Foxton Road, Alum Rock, Birmingham.—Particulars of claims by December 18th to the trustee, Mr. J. W. Blackham, 147, Corporation Street, Birmingham.

An "Exide" Sound Film.

The CHLORIDE ELECTRICAL STORAGE CO., LTD., has embarked on a new form of publicity in the production of a sound film. The title is "'Miking' a Talkie," and the chief entertainer is Mr. Tommy Handley. The greater portion of the film aims at the creation of an atmosphere of enjoyment and goodwill in the minds of the hearers, the reference to "Exide" batteries being imparted with the utmost brevity and speed at the end.

A Leicester Window-lighting Demonstration.

An excellent demonstration of shop-window lighting by electricity was arranged at the Bell Hotel, Leicester, on November 13th by Mr. Harry New, on behalf of Philips Lamps, Ltd., who co-operated with the Leicester branch of the Electrical Contractors' Association under the auspices of the Leicester Chamber of Trade. The audience was composed of members of retail associations affiliated to the Leicester Chamber, and there were also present a visiting party of about 70 from the Northampton Chamber of Trade and a large Nottingham contingent from the Distributors' Association and the Electrical Development Association Circle of that city. Mr. F. J. Smith, branch chairman of the E.C.A., presided. The demonstration was given by means of a window case set up in the hall containing every necessary kind of lighting already installed for use.

Belgian Electrical Imports and Exports.

According to a recent return, the imports of electrical machinery and apparatus into Belgium during last year attained a value of £2,407,050, as compared with only £1,649,200 in 1927. Germany is credited with about 30 per cent. of the imports, France with 23 per cent., Holland 16 per cent., Switzerland 8 per cent., the United States 7 per cent., and Great Britain 5 per cent. The exports of similar material from Belgium advanced from £1,704,200 in 1927 to £1,925,500 last year.

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Arapuni Scheme Settlement.

It was announced by the New Zealand Minister of Public Works recently that a settlement had been reached between the Government and Sir W. G. Armstrong, Whitworth & Co., Ltd., the original contractors for the Arapuni hydro-electric development. It was provided that the company should receive the scheduled rates so far as was possible for the work already done and an additional £30,000 for the preliminary work.

Receiver Appointed.

ELECTRODRIVES, LTD., Park Royal, N.W.10.—We are informed that the debenture holders have appointed a receiver and manager, who is now in control of the company's business.

Business Budgets.

Mr. A. G. H. Dent delivered an address to the Business Research and Management Association, on November 12th, on "Budgetry Control and Sales Analysis."

Radio Lectures.

The Marconiphone Co., Ltd., has prepared three lectures, each illustrated with lantern slides, dealing with screen grid valves and circuits; a.c. valves and circuits; and public speech and music amplifiers. Each is timed to last from thirty-five to forty-five minutes. The lectures and slides can be obtained from the Marconiphone Co., Ltd., Department I.D., 210-212, Tottenham Court Road, W.1.

Unemployment.

The Ministry of Labour returns showed an increase of 17,600 in the number of unemployed during the week ended November 4th. At that date the total was 1,252,000, as compared with 1,234,388 on October 28th, and 1,349,776 on November 5th, 1928.

New Belgian Company.

A company has recently been formed in Liège with a capital of 10 million fr. and the title La Société Omnium d'Affaires Electriques, to finance electrical undertakings.

Social Event.

The "Clesco" Light Operatic and Dramatic Club of the County of London Electric Supply Co., Ltd., presented an original musical show entitled "Elect Tricks" at King George's Hall, Caroline Street, W.C.1, on November 15th and 16th. The show was in "two phases and 24 shocks," all of which passed through the audience to earth leaving a feeling of exhilaration. The whole production, we were informed, was "home made," and the music by Mr. W. E. Dossett contained many tuneful numbers, while the lyrics by Messrs. A Ashdown and W. E. Dossett were full of humorous lines. The dancing of the eight Electron Girls proved a popular feature, and the staging of the production, under the direction of Mr. H. Frost, was excellent. The appreciation of the audience was shown when, at the fall of the final curtain on Saturday, the gifts of bouquets to the ladies transformed the stage into a miniature flower show. Our thanks to the Club for a pleasant evening.

The Timber Market.

Our Timber Trade Correspondent states that since his last report large shipments of Russian, Finnish, and Swedish wood have come forward, and stocks are now large. Prices generally are in favour of buyers for a time, but will firm up again with the close of navigation in Northern Europe, and with the wearing down of supplies during the coming winter. In the hard and fancy woods section of the trade a notable feature is the smaller supplies of mahogany logs coming forward, thus giving a still better tone to a firm market. Cedar, too, is in small supply, whilst other hard and fancy logs are reaching us in limited quantities at firm rates. Teak is very strong in price, as are also the Empire varieties generally. American woods are still weak, with stocks on hand large. Plywood is arriving in record quantities, and stocks are plentiful.

Prices of Raw Materials.

Messrs. F. Smith & Co. and Messrs. James & Shakespeare report; November 19th: No change in copper prices.

Messrs. James & Shakespeare report, November 19th: English pig lead, £23 5s., 5s. inc.

Messrs. Edward Till & Co. report, November 19th: India-rubber, Para fine, 8½d., ½d. dec.

Reporting on the lead market on November 16th, Messrs. James Forster & Co. said that since the 11th inst. the market had been supported by the Producers' Association, with the result that prices had recovered 15s. per ton from the lowest level touched. The advance was assisted by a better tone in the other metal markets. The American price is unchanged at 6.25 cents. "The heavier arrivals expected have not so far materialised, reports being that metal has been diverted to other ports than London. But for this, producers would have found it difficult to get prices up to the present level as consumers' demand is very quiet, while arrivals, though moderate, are sufficient for current needs. There seems little in the position to justify the present price for the metal, although producers may temporarily maintain or even raise prices further. The Board of Trade returns for October, 1929, are:—Imports, 20,299 tons; exports, 7,315 tons; leaving for home consumption 12,984 tons.

Lighting and Power Notes.

Accrington.—ADMINISTRATION.—The Corporation Electricity and Tramways Committee is to be divided. The two departments are in future to be separate sections and the tramways and 'buses will be under joint control.

Algeria.—ELECTRICAL DEVELOPMENTS.—Considerable development of the electric power supply facilities in Algeria are in progress. In the Algiers district the Société Algérienne d'Eclairage et de Force has decided to erect a new power station with two 12,000-kW turbo-generator sets. In the Oran area, the plant at the Mers-el-Kebir station is to be extended by the addition of a 3,000-kW turbo-generator set, and later by one of 6,400-kW capacity. In conjunction with the Société des Forces Motrices d'Algérie the company is also preparing plans for a power station in the Kabylie area.

Birtley.—PUBLIC LIGHTING.—The Parish Council has received sanction to a loan of £2,600 for converting the public lighting from gas to electricity. Energy will be supplied by the County of Durham Electrical Power Distribution Co., Ltd.

Box.—INAUGURATION OF SUPPLY.—A supply of electricity, provided by the West Wilts Electric Light & Power Co., Ltd., was inaugurated recently. The company has carried out a contract for street lighting.

Burnley.—UNEMPLOYMENT SCHEME.—The Electricity Committee has received approval to an electricity scheme for the relief of unemployment. It provides for the extension of a h.p. feeder from Brunshaw to Plumbe Street; the laying of an e.h.p. feeder from Every Street to Rosehill; and the replacement or renewal of various mains. Tenders for the supply of cables have been accepted.

Buckland.—ELECTRICITY SUPPLY PETITION.—At a meeting held recently of the ratepayers and householders of the parish, it was decided to send another petition asking the Minister of Transport to reject the Dorking Special Order and to grant permission to the Central Electricity Board and the London and Home Counties Joint Electricity Authority to carry out their electricity scheme for the district.

Caernarvon.—TRANSFER OF UNDERTAKING.—The Town Council has decided to take over the electricity undertaking which, since its inception 24 years ago, has been carried on on behalf of the Council by the National Electric Construction Co., Ltd Proposals had been made by the company for renewing the agreement for 10 years, but these were rejected by the Council.

THE DOMESTIC LOAD.—In an address given at Carnarvon a few days ago Mr. Percy White, Bangor borough electrical engineer, expressed the view that ultimately the domestic load would absorb the greater part of the output of all electricity undertakings. In the North Wales area the North Wales Power Co., Ltd., supplied electricity in bulk to 52 authorities. With the facilities that were now available it should be possible to make rapid strides in the development of the heating and cooking load as distinct from the lighting load, particularly as there were hire-purchase schemes for the acquisition of appliances. Load curves were exhibited showing the output of electricity from the Carnarvon supply for summer and winter, which plainly indicated the effect of shop lighting on the consumption of electricity.

Canada.—HYDRO-ELECTRIC DEVELOPMENTS.—The first step towards the development of 250,000 h.p. at Chats Fall, on the Ottawa River, 35 miles north of Ottawa, has been taken by the awarding of a contract to the Marrow and Beatty Company, of Peterborough, for the construction of a 30-ft. dam on the Quebec side of the river. The contract was given by the Royal Securities of Montreal, who control the power rights at this point, and the contract price is understood to be approximately $2,000,000. The work on the Ontario side will be done by the Ontario Government. When completed the dam will stretch across the river for a distance of 1¼ miles, and will constitute the largest single power development on the Ottawa River; it will back up the waters of the river for a distance of between 12 and 15 miles.

Arrangements have been made which will enable work on the construction of the power plant of the Montreal Island Power Co., on Back River, near that city, to be proceeded with. The contract was held by the P. Lyall Construction Co., of Montreal, which recently went into liquidation. On account of the urgency of the work the court authorised the payment of $29,918 to a sub-contractor, securing the continuance of operations.

Continental.—RUSSIA.—The Soviet Government has recently placed a contract with the Siemens-Schuckertwerke Co., of Berlin, for two 44,000-kW turbo-generator sets for the Schterowka electric power station in the Donetz mining district.

SPAIN.—A recent return shows that Spain has now 101 hydro-electric companies, operating 118 installations. With average water supply which prevails during nine months of the year, they produce a total of 757,422 h.p., according to the estimate of the "Anuario Estadistico de Espana," or 1,300,000 h.p. according to the estimates of the industry. "The Boletin" of the Banca Arnus Gari of Barcelona places Spanish electrical production from all forms of power at 1,848,831,673 kWh for 1928, as compared with 1,707,730,514 kWh in 1927.

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Dover.—Loan.—The Town Council has applied for sanction to a loan of £2,000 for general mains.

Epsom.—Year's Working.—The accounts of the Urban District Council's Electricity Department (engineer: Mr. H. W. Watts) for the twelve months ended March 31st last record an increase in total revenue from £24,257 to £27,998. Working expenses were £18,554, as compared with £18,387 in the preceding year, leaving a gross profit of £9,444 (£5,870), to which was added revenue from the sale of fittings and interest on investments, making a total of £9,476 available. After providing for capital and other charges, there was a net surplus of £774, as compared with a net deficiency of £830 in 1927-28. The sales of electricity increased from 1,710,592 to 2,338,190 kWh, and the maximum supply demanded from 1,000 to 1,341 kW.

Ealing.—Electricity Supply.—A l.p. cable to distribute electricity to Islip's Manor and the Northolt Housing Estate is to be laid by the Uxbridge and District Electric Supply Co., Ltd. The estimated cost of the house services, to be paid by the Town Council, is £3 3s. 10d. per house, and tenders are to be obtained for wiring the houses.

Eston.—Loans.—The Urban District Council Electricity Committee is applying for sanction to loans of £1,000 for rental wiring, £1,000 for services, £1,500 for meters, and £250 for domestic apparatus.

Exeter.—New Plant Installed.—A new 3,500-kW turbo-alternator was started up recently at the electricity works by Mrs. Arthur Brock, the deputy-Mayoress, vice-president of the East Devon Branch of the Electrical Association for Women, and wife of the chairman of the Electricity Committee.

Gravesend.—Year's Working.—We have received from Mr. C. F. McInnes, borough electrical engineer, a copy of the accounts of the Corporation electricity undertaking for the year ended March 31st last. The total revenue amounted to £73,314, as compared with £70,024 in the preceding year, while the working expenditure dropped from £31,982 to £30,717. The gross profit was £42,597, as compared with £38,042 in 1927-28. Dividends on investments were added to the gross profit, making a total of £42,621 available. Of this £13,866 was absorbed by interest charges, and £11,523 by contribution to the sinking fund. The net profit, including £23 dividends on investments and subject to income tax, was £17,231, as compared with £15,384 in the preceding year. The capital expenditure during the year amounted to £38,367, the principal item being £24,316 for mains. The total now spent on the undertaking stands at £419,658. The electrical energy sold increased from 13,878,005 to 15,968,595 kWh, and the maximum supply demanded from 5,100 to 6,200 kW.

Mains Extensions.—The Corporation Electricity Committee is to extend mains at a cost of £1,500.

Greenock.—"Grid" Supply.—The work in connection with the Central Electricity Board's scheme is now well advanced and preliminary testing has commenced. Preparations are now being made to make the 132,000-V transmission lines between Yoker and Greenock "alive." After the plant at the Dellingburn end has been tested the Greenock supply will be run in parallel with the Clyde Valley station at Yoker.

Guildford.—Mains Extensions.—The Corporation Electricity Committee is to extend mains at Chilworth, at a cost of £1,000, and at Gomshall, at a cost of £492.

Japan.—Hydro-Electric Development.—The Hida Electric Light Company has obtained sanction to the erection of a hydro-electric power station in Gifu Prefecture.

London.—Islington.—The Borough Council Electricity Committee is to convert street lamps from gas to electricity in Copenhagen Street, Isledon Road and Tollington Road at a total cost of £1,720.

Lowestoft.—Loans Sanctioned.—The Corporation Electricity Committee has received sanction to the borrowing of the following amounts in connection with the provision of a supply of electricity to Kessingland:—£10,572 for mains and services and £3,410 for plant.

Peak Load Reduction.—The Corporation Electricity Committee has decided that, in order that the payments to be made to the Great Yarmouth Corporation in respect of the bulk supply of electricity may not be unduly inflated by the operation of the peak load charge, the general manager shall circularise consumers suggesting that they should reduce the consumption of electricity to a minimum between the hours of 4.30 and 6 p.m. during the months of November and December. The committee has also decided to reduce the lighting of Normanston Drive by one-half until after 6 p.m. in the evenings during those months.

Manchester.—Progress during September.—During September the Corporation electricity undertaking showed an increase in connections of 2,038 kW, bringing the total up to 395,983 kW. The number of applications received for supply, including those for additional supplies, amounted to 1,304, representing a total of 2,876 kW. The number of hired cookers connected increased by 81, making the total number of cookers actually connected 5,605. Applications for the hire of cookers totalled 112. One new sub-station was put into commission, and additional plant installed at the Ancoats sub-station. The change-over from d.c. to a.c. had been completed in the cases of 8,502 consumers up to October 11th, and sanction had been given and work was in progress involving 1,178 consumers.

Middleton-St. George.—Public Lighting.—The Parish Council is to apply for sanction to borrow £700 for the provision of electric street lighting in the parish.

Newcastle.—Tariff Inquiry.—A Government inquiry into the charges for electricity in Newcastle is to be held on December 17th.

Portland.—Shop-lighting Meters.—The Urban District Council Electricity Committee has arranged that two-rate meters shall be installed for shop lighting, provided that a minimum of 120 watts be connected on the shop-lighting circuit.

Price Reduction.—Turton.—The Urban District Council is to make the following reductions in the charges for electricity from January 1st next:—Lighting: From 6d. to 5½d. per kWh, with a minimum of £1 per annum. Heating, cooking, and domestic power: First 25 kWh per quarter, 2d. per kWh; over 25 kWh, 1d. per kWh. Power for industrial purposes: First 300 kWh per quarter, 3d. per kWh; next 200 kWh, 2d.; over 500 kWh, 1½d., with a minimum of £1 per annum.

St. Helens.—Special Order.—The Town Council has applied for a Special Order authorising it to supply electricity to the parish of Bold, and to a part of the township of Burtonwood.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the Soham & District Gas Co., Ltd., to supply electricity in the parishes of Soham, Fordham, Burwell, Isleham and Wicken, in the rural district of Newmarket; and by the Exe Valley Electricity Co., Ltd., to extend its area of supply so as to include various parishes in the rural districts of Crediton, St. Thomas and Torrington.

The Electricity Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Torquay Corporation to supply electricity in the urban district of Ashburnham and Buckfastleigh, and in parts of the rural districts of Newton Abbot and Totnes; the Holderness Trust, Ltd., to supply electricity in the urban district of Hornsea and in part of the rural district of Skirlaugh; James Lewis Hamilton Williams to supply electricity in the borough of the town and county of Haverfordwest; and the Pontardawe Rural District Council to supply electricity in part of the rural district of Pontardawe.

Stirlingshire.—Electricity Supply.—A recommendation by the Housing Committee that the housing scheme at Bannockburn be wired for electric lighting and that no provision be made for gas lighting or cooking was approved by the Central District Committee of the County Council at a recent meeting.

Wakefield.—Undertaking Purchase Offer Rejected.—The Town Council has rejected the offer of the Yorkshire Electric Power Co. to purchase the Corporation electricity undertaking for £250,000 plus a further substantial sum.

Walsall.—Mains Extensions.—The Corporation Electric Supply Committee has received authority to extend mains at a cost of £3,150 to supply houses on the Wolverhampton Road.

Warwickshire. — Sanatorium Electricity Supply. — The County Hospitals Committee reports that owing to the many extensions to the sanatorium and the large number of attendances in the artificial light department, it has been found necessary to consider amplifying the electrical and heating services. It is therefore obtaining the advice of an independent consulting engineer to report on the minimum, immediate and permanent work necessary to provide efficient electrical and heating services, but adaptable for further extension if necessary.

Whitehaven.—Special Order.—The Town Council has decided to apply for a Special Order to supply electricity to Preston Quarter, Sandwith, and Hensingham.

Winchester.—Electricity Supply.—The City Council has received sanction to a loan of £8,567, part of the cost of supplying electricity to the parishes of Twyford and Compton.

Worthing.—Restricted Supply.—The borough electrical engineer has called the attention of the Town Council to the fact that, owing to the delay in receiving the additional power to be furnished by the Central Electricity Board from Southwick, the generating plant at the Corporation's power station is inadequate fully to satisfy consumers' normal requirements until the external service is available. He suggests that a circular letter should be sent to all consumers requesting them to reduce their demands between the hours of 4 p.m. and 8 p.m., except on Sundays, as follows:—(*a*) Indoor lighting installations: Use one lamp less than usual where more than one is ordinarily in service at one time. (*b*) In mixed heating and lighting installations: Use one lamp less than usual as in (*a*) and one radiator bar less; or one complete radiator less where more than one is ordinarily used at one time. (c) Shop windows and display installations: Reduce by one-half. (*d*) Electric motors, &c.: Reduce the use of motors and other special apparatus. Also he proposes that consumers should be further requested not to add to their installations until notice has been received that normal use may be resumed. The Town Council has adopted the suggestions, and the Highways Committee has also been asked to reduce the street lighting as much as possible. The town clerk has further been requested to communicate with the Central Electricity Board protesting against the delay, and urging it to complete the laying of the transmission lines and to commence the supply promised as soon as possible.

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Tramway and Railway Notes.

Australia.—MELBOURNE.—The Victoria State Ministry is to introduce a Bill authorising the Melbourne and Metropolitan Tramways Board to borrow £750,000 for the purpose of converting cable tramways to electric traction. Details are being prepared with regard to the cost, &c., of the conversion of the Brunswick Street (North Fitzroy), South Melbourne and Port Melbourne lines. It is stated that no further conversions can be undertaken till the end of the current year, and till the Collins Street line is completed. The amount to be provided for by the Bill may not be sufficient to carry out all these conversions, and adjustments may have to be made. The Tramways Board some time ago indicated to the Fitzroy Council that the conversion of the Brunswick Street line would follow immediately on the conversion of the Collins Street line. It is stated by the *Melbourne Argus* that the Port Melbourne line may be abandoned, and a 'bus service instituted round Fisherman's Bend.

Plans for the control of the metropolitan tramways are being discussed by the State Cabinet. The term of appointment of the Board will expire at the end of the year, and the Ministry desires to arrange for the creation of a reconstituted authority to control the tramways. The lack of reasonable tenure is said by members of the Board to prevent any continuity of policy, thus hampering effective administration.

Continental.—DENMARK.—The long-projected electrification of the private railway between Copenhagen and Slargerup is now to be carried into effect. The directors are negotiating with the A.E.G. and the Swedish A.S.E.A. on the basis of the estimates submitted by them some time ago.

NORWAY.—Of the 2,480 miles of railways in Norway approximately 100 miles had been electrified up to the end of last year. The electrification of the line from Drammen to Kongsberg is, however, nearing completion and is expected to be open to traffic shortly. When the Drammen bridge is completed it will be possible to run electric locomotives from Oslo to Kongsberg. Preliminary work on the electrification of the line from Kongsberg to Notodden, Skien, and Brevik has been started. The work of electrifying the Hoved railway has been completed from Oslo to Lillestrom and work on the remaining section is under way.

SWITZERLAND.—At the next meeting of the Conseil d'Administration of the Swiss Federal Railways the programme will be laid before the Board as to the next stage in the electrification of the railways for the coming seven years. The length of line affected is estimated at 476 km., and the proposed budget amounts to 81 million fr. Out of this sum three millions will be needed for the strengthening of bridges and viaducts, and 34,000 fr. for the purchase of tractors.

Hastings.—RAILLESS CARS.—The Hastings and District Electric Tramways Co., Ltd., is introducing a Bill in Parliament applying for powers to run railless cars on new routes in the town, and also to Battle.

Leyton.—THE L.C.C. TRAMWAY AGREEMENT.—At a meeting of the Urban District Council held recently it was stated that, unless Leyton provided fifty new trams, the London County Council was not prepared to consider the renewal of the agreement under which the tramway undertaking is operated by the L.C.C. It was decided that the question of purchasing fifty new cars at a cost of £150,000 should be postponed for one month.

London.—RAILLESS CARS.—A Bill is to be promoted in Parliament to enable the London United Tramways Co., Ltd., to substitute railless cars for trams on existing routes. Should Parliamentary sanction be given, experimental services will be run on the company's routes between Tolworth, Surbiton, the Dittons, Teddington, Twickenham, and Kingston, and between Kingston and Richmond Park gates on Kingston Hill.

Newport (Mon.).—RAILLESS CARS.—The Town Council has decided to replace some of the tramways by railless cars, and also to seek powers to run these vehicles outside the borough.

Northern Ireland.—BELFAST.—The City Council is to consider the question of purchasing an additional fifty tramcars.

The Southern Railway.—EXTENSION SCHEMES.—Among improvements and extensions for which the Southern Railway Company is to seek Parliamentary powers is the construction of a new railway, described as the Motspur Park and Leatherhead Railway, linking up the Wimbledon and Epsom line south of the Blue House level crossing with the Epsom and Leatherhead line north-east of the railway bridge carrying the Kingston road.

Telegraph and Telephone Notes.

Irish Free State.—WIRELESS-TELEPHONY.—Wireless-telephone apparatus, which will keep the islanders off the coasts of West Galway and Mayo in constant touch with the mainland, has been installed by the Irish Post Office at Clifden, Bofin, and Clare Island. The apparatus has been tested by Post Office officials, and communication will now be possible in any weather.

Switzerland.—NEW RADIO STATION.—The country entered into the possession of another wireless station on November 7th. Mr. Haab, president of the Confederation and a delegate for Switzerland to the League of Nations, opened the new and important plant at Prangins, near Nyon, on Lake Léman.

The Telephone Service.—RECORD YEAR IN PROSPECT.—Comparative figures of world telephone development for eight years since 1920 show that of the seven countries with the greatest telephone density, Australia alone shows a greater percentage increase than Great Britain during that period. Since 1920 telephones in Australia have increased by 111 per cent.; in Great Britain by 78 per cent.; in Germany by 63 per cent.; in Canada by 57 per cent.; in the United States by 42 per cent., in Denmark by 30 per cent., and in Sweden by 22 per cent. "It may perhaps be urged," says the *Telegraph and Telephone Journal*, "that it is easier to show a high percentage development on one million than on thirteen million telephones, and that the countries with low telephone densities should exhibit a more rapid growth. This, however, is not altogether the case, for telephone history shows that at that period when countries begin to reach a high density the development curve begins to soar upwards. In other words, when the telephone habit is already firmly established, the demand for the telephone by those who have it not becomes the more insistent." Regarded from this point of view, it is noteworthy that Britain's telephone increase grows yearly greater; in 1927 it was 121,000; in 1928 it was 125,000; and in 1929 it should be between 128,000 and 129,000. There is thus reason for hope that England is now beginning to make up some of her very considerable leeway in telephony affairs.

NEW INSTRUMENTS.—The House of Commons was informed by Mr. Viant, Assistant Postmaster-General, that a new hand combination telephone instrument was being introduced as an alternative to the present "candlestick" pattern, and supplies were expected about the end of the year. The new pattern would be more costly to provide and maintain than the old instrument, and subscribers who desired to have it installed would, accordingly, be asked to pay an additional charge of 4s. a quarter.

NEW WORK.—Mr. Lees-Smith, Postmaster-General, recently informed the House of Commons that the new constructional work contemplated, which was to cost £750,000, was in addition to the authorised programme for the year, which would cost £10,500,000. The additional work would be put in hand forthwith.

Radio Notes.

Canada.—RELAYS—A programme of 25 national broadcasts, to be given this winter over its new Atlantic-to-Pacific wireless "chain," has been arranged by the Canadian National Railways. It will involve the use of 16 stations, stretching from Halifax, N.S., to Vancouver, and approximately 15,000 miles of land wire. Some conception of the engineering difficulties involved is indicated by the fact that five different time zones are covered, each representing a difference of one hour.

France.—RADIO CONFERENCE.—The National Wireless Conference concluded its labours last week. Among the papers read on the last day were some concerning broadcasting and popular education; broadcasting and moral influence, authors' rights, broadcasting and the Press, and wireless programmes. No decisions were come to by the Conference with regard to the Wireless Statute, which will eventually legally determine the status of this new factor in the nation's life.—*Reuter's* (Paris).

Germany.—FINANCE.—The Reich Commissioner for Broadcasting announces that receipts during 1928 amounted to £1,600,000, almost entirely derived from fees. Expenditure totalled £1,440,000, the cost of programmes (including the sums paid to performers, orchestras, and theatres) being £610,000. Electric power cost £240,000. A dividend of 7½ per cent. has been distributed and £55,000 carried forward. Of the share capital, 25½ per cent. is in private hands and the balance held by the Reich Postal Ministry, the State Governments, Municipalities, and public bodies.

Italy.—NEW STATION.—The first Italian high-power station, which will have cost £200,000 to equip and will be one of the most powerful in Europe, will be opened on November 28th. It is situated at Santa Polomba, 15 miles from Rome, on the Roman Campagna.

U.S.A.—RADIO-FREQUENCY PATENT.—The Radio Corporation of America has been informed that a decision has been handed down by the Privy Council, the highest appellate tribunal in the British Empire, upholding the Alexanderson tuned radio-frequency patent against the Schloemilch and von Bronk patent. The case went to the Privy Council in London on appeal from the decision of the Supreme Court in Canada. The *T. & T. Age* explains that in the Canadian litigation, the Alexanderson patent was sustained by the lower court, which decision was reversed by the Supreme Court of Canada, after which jurisdiction of the controversy was taken by the Privy Council. The two patents had already been considered by two Federal District Courts of the United States, both of which had decided in favour of the Alexanderson patent.

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Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—Melbourne.—Posts and Telegraph Department. January 7th. Telephone hand sets. (B.X. 5823.)* Contact pressure testers. (B.X. 5821.)*

January 14th. Ringing motor-generator sets for automatic telephone exchanges. (B.X. 5839.)* Telephone indicators. (B.X. 5822.)*

January 13th. State Electricity Commission of Victoria. 2,200-V switchgear and accessories. (B.X. 5827.)*

Sydney.—December 16th. Public Works Department. Electrically-driven pumping set for the Junce water supply. (A.X. 8740.)*

Edinburgh.—December 2nd. Education Authority. Electric lighting and heating installation, in connection with extensions at Lochend Road school. Specifications, &c., from Mr. J. M. Johnston, 47, Charlotte Street, Leith.

Egypt.—Cairo.—December 28th. Ministry of Public Works. Electric generating and pumping sets for Mankabad Barracks. (B.X. 5842.)*

Hull.—December 19th. Electricity Department. Supply of electricity meters. (See this issue.)

London.—Stepney.—December 5th. Board of Guardians. Installation of wireless receiving apparatus at each of its three hospitals. The apparatus required will include 1,159 headphones and 24 loud-speakers. (November 15th.)

Commissioners of H.M. Works, &c.—November 28th. H.p. and l.p. switchgear, transformer and cables for H.M. Office of Works generating station, South Kensington. (November 15th.)

Central Electricity Board.—December 21st. Supply, delivery, and erection of 132,000-V transformers for the Mid-East England Electricity Scheme, 1929. (See this issue.)

Millom.—December 20th. Urban District Council. E.h.p. and l.p. cables, pillar box, &c., and e.h.p. and l.p. switchgear, transformer, &c., for the Haverigg extension scheme. (See this issue.)

New Zealand.—Wellington.—Post and Telegraph Department. January 13th. Four point jacks. (B.X. 5840.)*

January 16th. Telephone switchboard plug covers. (B.X. 5879.)*

Christchurch.—December 13th. Christchurch Drainage Board. Four electrically-driven pumping plants and two horizontal type 3 h.p. a.c. motors, direct coupled with centrifugal sewage pumps. (A.X. 8788.)*

Public Works Department. January 14th. Two air compressors and two electric motors. (A.X. 8784.)*

January 28th. Three 50-kW, oil-immersed, circuit breakers for Arapuni. (B.X. 5878.)*

Salford.—November 25th. Corporation. Electric travelling and slewing jib crane. (November 8th.)

South Africa.—Bloemfontein.—December 2nd. Waterworks Department. Two low-lift and two high-lift electrically-driven pumping units, with cables, starters, &c. (A.X. 8710.)

December 2nd. Municipal Council. Copper conductors, poles, transformers, and switchgear. (B.X. 5825.)*

Pretoria.—December 27th. Posts and Telegraph Department. Telegraph material. (A.X. 8734.)*

Catooma, Rhodesia.—December 12th. Municipal Council. Two boilers, steam engines, alternators and switchboard. (A.X. 8749.)*

Spain.—Madrid.—Tenders will shortly be invited for the supply of a 10-ton electric crane for the port of Marin (Pontevedra) and of four electric cranes for the port of Vigo.—*Reuter's Trade Service* (Madrid).

Stockport. — December 2nd. Electricity Department. Supply, delivery and erection of 6,600-V switchgear. (November 8th.)

Stone.—November 25th. Electricity Department. E.h.p. overhead 11,000-V transmission line (2,300 yd.); two 50-kVA sub-stations, and l.p. overhead distribution services (1,400 yd.), &c. (November 8th.)

West Ham.—November 28th. Union Guardians. Installation of fire-alarm system, Whipps Cross Hospital, Leytonstone. (See this issue.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Coventry.—Board of Guardians.
Electric lighting and bell installation at Exhall Hospital (£177).—Burbury, Laird & Co.

Glasgow.—Lighting Committee. Accepted:—
20,000 yd. 7/.036-in. cable, Metropolitan Electric Cable and Construction Co., Ltd.; 6,000 yd. 7/.064-in. ditto, British Electrical & Manufacturing Co., Ltd.
300 37-ft. 6-in. steel poles, 200 28-ft. steel poles.—Stewarts and Lloyds, Ltd.
Street lanterns.— General Electric Co., Ltd.

Hampton.—Urban District Council. Accepted:—
Overhead cable to sewage works; wiring, fittings, &c. (£127).—Twickenham & Teddington Electricity Supply Co., Ltd.

Limerick.—Committee of Management, Limerick Mental Hospital.
Wiring the Institution (£1,750).—Fitzgerald & Co. (Accepted.)

Liverpool.—Mersey Docks and Harbour Board. Accepted: Electric cables, &c.—British Insulated Cables, Ltd.

London.—London County Council.—Highways Committee. Accepted:—
Electric lift for boiler house at Greenwich power station (£696).—Express Lift Co., Ltd.
Machined bronze bearings (£4,177).—Anti-Attrition Metal Co., Ltd.
3,000 driving wheel tires and 3,000 pony wheel tires.—Hadfields, Ltd.
700 tons of rolled mild steel bar.—Cargo Fleet Iron Co., Ltd.
100 commutators.—Dyer & Young, Ltd.
24,000 tie bars.—Bayliss, Jones & Bayliss, Ltd.

Switchgear for Greenwich, Limehouse, Tooting, and New Cross tramway sub-stations:—

Switchgear & Cowans, Ltd. (Accepted.)	£10,492
A. Reyrolle & Co., Ltd.	11,908*
Bertram Thomas	11,973
Park Royal Engineering Co., Ltd.	12,187*
English Electric Co., Ltd.	12,218
General Electric Co., Ltd.	12,267
Metropolitan-Vickers Electrical Co., Ltd. ...	12,267
Ferguson, Pailin, Ltd.	12,305
British Thomson-Houston Co., Ltd.	12,595*
Johnson & Phillips, Ltd.	12,659
New Switchgear Construction Co., Ltd. ...	23,910

* Tender subsequently withdrawn.

Metropolitan Water Board.
Boiler plant for Deptford pumping station (£26,945).—John Thompson Water-Tube Boilers, Ltd. (Recommended.)
Two electric pumps for Kempton Park works (£174).—Salaman Hardoll, Ltd. (Accepted.)

Islington.—Electricity Committee. Recommended:—
Installation work in connection with wiring schemes. Extension of contract for 12 months.—E. H. Finn.

Great Western Railway Co.
Part contract for the supply of gasfilled, vacuum ordinary and train lighting lamps.—Metro-Vick Supplies.

Hammersmith.—Electricity Committee. Accepted:—
Four 1,000-kVA transformers (£1,590).—British Electric Transformer Co., Ltd.
H.p. switchgear (£641).—A. Reyrolle & Co., Ltd.

Stoke Newington. — Electricity Committee. Recommended:—
Prepayment-type meters for 12 months.—Measurement, Ltd.
Installation work under assisted wiring schemes for 12 months.—A. R. Carnidge & Co. for 4- to 6-point installations wired in lead-covered cable system (18s. 3d. per point).
Section pillars (£325).—Lucy & Co.

Newport.—Great Western Railway Co. Accepted:—
Transformers for nine 3-ton cranes at South Quay, South Dock.—Crompton Parkinson, Ltd.

Southend-on-Sea.—Town Council. Accepted:—
Reconstructing the cliff lift (£3,075).—Waygood-Otis, Ltd.

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Forthcoming Events.

Physical Society.—Friday, November 22nd. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

Birmingham Electric Club.—Friday, November 22nd. Grand Hotel, 7 p.m. "Dust Explosions." Mr. J. D. Morgan.

Electrical Power Engineers' Association (Kent Section).—Saturday, November 23rd. Royal Star Hotel, Maidstone, 6 p.m. Annual dinner.

(London Technical Group).—Tuesday, November 26th. Junior Institution of Engineers, 39, Victoria Street, S.W., 7.15 p.m. "Protective Apparatus." Mr. R. O. Kapp.

(London Central Section).—Friday, November 29th. Slater's Restaurant, High Holborn, W.C. Annual dinner.

(Derby Section).—Saturday, November 23rd. Black Boy Hotel, Nottingham, 6.45 p.m. Annual dinner.

(Manchester Section).—Thursday, November 28th. Geographical Hall, Manchester, 7 p.m. Address by the President, Mr. T. D. Martin.

Liverpool Industrial Section.—Saturday, November 23rd. Bear's Paw Café, Liverpool. Annual dinner.

Institution of Electrical Engineers.—Informal Meeting.—Monday, November 25th. Institution, London, W.C., 7 p.m. Discussion on "Wooden Poles for Overhead Transmission Lines and their Preservation," to be opened by Mr. C. Wade.

Thursday, November 28th. Institution, London, W.C., 6 p.m. "Voltage Control of Large Alternators." Mr. H. W. Taylor.

(North-Eastern Centre).—Tuesday, November 26th. Armstrong College, Newcastle-on-Tyne, 7 p.m. Faraday Lecture, "Broadcasting by Electric Waves." Captain P. P. Eckersley.

(North-Midland Centre).—Tuesday, November 26th. Hotel Metropole, Leeds. 7 p.m. "Surges and Overvoltage Phenomena on Transmission Lines due to Lightning and Switching Disturbances." Dr. H. Norinder.

(North-Western Centre).—Tuesday, November 26th. Engineers' Club, Manchester, 7 p.m. "The Heating of Buildings Electrically by Means of Thermal Storage." Lieut.-Col. S. E. Monkhouse and Mr. L. C. Grant. (Joint meeting with the Manchester Association of Engineers.)

(Scottish Centre).—Tuesday, November 28th. Grosvenor Restaurant, Glasgow, 6.30 p.m. Annual dinner and dance.

(South-Midland Centre).—Friday, November 29th. Grand Hotel, Birmingham, 7 p.m. Annual dinner.

(East-Midland Sub-Centre).—Tuesday, November 26th. The University, Nottingham, 6.40 p.m. "Low Temperature Carbonisation of Fuel, with special reference to its Combination with the Production of Electricity." Mr. E. H. Smythe and Mr. E. G. Weeks.

(North-Eastern Students' Section).—Friday, November 22nd. Grand Assembly Rooms, Barras Bridge. Annual dance.

Mersey & North Wales (Liverpool) Centre.—Wednesday, November 27th. University Club, Liverpool. Annual dinner.

Institute of Marine Engineers.—Tuesday, November 26th. The Institute, The Minories, E., 6.30 p.m. "The Origin and Development of Heavy Oil Engines." Mr. A. F. Evans.

Friday, November 29th. Hotel Victoria, 7 p.m. Annual conversazione.

Electrical Trades Benevolent Institution.—Tuesday, November 26th. Savoy Hotel, W.C. Annual dinner and dance.

Institute of Physics.—Wednesday, November 27th. Institution of Electrical Engineers, Savoy Place, W.C., 5.30 p.m. "Physics in Relation to the Utilisation of Fuel." Dr. C. H. Lander.

Royal Society of Arts.—Wednesday, November 27th. John Street, Adelphi, W.C.2, 8 p.m. "The Examination of Coal and Coke by X-rays." Mr. C. N. Kemp.

Institution of Mechanical Engineers.—Friday, November 29th. Institution, Storey's Gate, S.W., 6 p.m. Debate on "The Registration of Reliable Tests of Power Plant Machinery," to be introduced by Mr. R. H. Parsons.

Junior Institution of Engineers.—Friday, November 29th. 39, Victoria Street, S.W., 7.30 p.m. "Modern Welding Systems and Applications." Mr. W. C. Freeman.

Mishap at Nechells.

According to *The Times*, an explosion, followed by a fire, occurred shortly after midnight on Tuesday at the Prince's power station at Nechells, one of the principal generating stations under the control of the Birmingham Corporation, and for a time the supply of electricity was interrupted over a wide area.

Notes.

Inquiry at Barnes.

An inquiry was held on November 13th and 14th, at the Barnes Council Offices, by Col. T. C. Ekin, inspector of the Electricity Commissioners, into the application of the Barnes Urban District Council for consent to extend its generating station. The application was opposed by the London and Home Counties Joint Electricity Authority. Presenting the case for the Council, Mr. F. J. Wrottesley stated that the electricity undertaking, which came into existence in 1902, had progressed so satisfactorily that to-day it was able to show the sale of 10½ million kWh per annum. Giving evidence, Mr. C. S. Davidson, the Barnes electrical engineer, produced a table of returns for several years. On being cross-examined by Sir Lynden Macassey, the representative of the London Joint Authority, Mr. Davidson at length admitted certain inaccuracies in the figures as submitted to the Electricity Commissioners. Referring to these figures, Sir Lynden Macassey compared them with a table of revised figures which had been prepared, and showed various discrepancies in the distribution costs and in the estimated consumption. Sir L. Macassey, outlining the London Joint Authority's opposition, said that they had been described by Mr. Wrottesley as "middle-men," but that it was a little late in the day to adopt a position of that sort, since everything proposed by his clients was in harmony with the Act of 1926. Also, as the Joint Authority, they were able to supply electricity on much more favourable terms than Barnes could generate it. Mr. F. W. Purse, chief engineer of the London and Home Counties Joint Electricity Authority, stated that the figures of Mr. Davidson were rather optimistic, but even so his Authority had made an offer, and would stand by it. Mr. Purse added most emphatically that the proposed arrangement with Barnes would show no profit to the Joint Authority, and that any loss incurred would be borne by the Central Electricity Board.

The Commissioners will give their decision in due course.

Fatality.

An inquest was held at Stafford on November 4th on John Ecclestone (57), who received a fatal electric shock on the premises of the English Electric Co., Ltd., on October 31st. Frederick Emberton, a tester for the company, said that Eccleston was assisting him to connect up a 2,500-h.p. motor. He was instructed to change a transformer and connect a phase advancer which were "dead," but he was not told to put the cable on the busbars. Alex John Dan, a tester, said that the temperature of his machines was constant and he shut them down. Having taken the temperature he ran one of the machines up again. He got up to about 2,400 V when he heard several people shout and he immediately had the supply cut off again.

It was suggested that deceased connected one of the cables to the bars under the impression that Dan had finished. A verdict of "accidental death" was returned.

Electricity in Mines.

The report for 1928 of Mr. J. A. B. Horsley, H.M. Electrical Inspector of Mines, contains much of interest to all electricians, managers, and others concerned with electrical equipment in mines. Progress in electrical development at mines under the Coal Mines Act is analysed in detail. The total horse power of motors installed was 1,722,332, or 38,000 h.p. greater than in 1927. Electricity was used at 1,467 mines. The statistical tables include a regional analysis of the h.p. of motors installed, showing the comparative use of direct current and alternating current, and analyses (with comparative figures for 10 years) of fatal accidents classified according to the type of accident, the employment of the persons killed, and the nature of the equipment involved. The inspector describes the 15 fatal accidents attributable, either directly or indirectly, to the use of electricity which occurred during the year, and makes suggestions with a view to preventing accidents of a similar nature in future. He also gives particulars of three dangerous occurrences of an unusual nature, and describes 21 recent electrical accidents involving trailing cables and plugs. The inspector classifies the latter, and discusses the design of plugs and trailing cables. With regard to coal-cutting machines, general analyses of the number and description of machines in use at coal mines during the last ten years are given, together with regional analyses of the quantities of machine-cut coal and other mineral got by electricity and by compressed air; 25.2 per cent. of all coal mined during 1928 was machine-cut, and 65.9 per cent. of machine-cut coal was got by means of electric coal cutters. The inspector draws attention to the interest which is being shown in the application of automatic starters (remote control to coal-cutting machines, and to the practicability of the standardisation of trailing cables, which is now being investigated by the British Engineering Standards Association. Copies of the report (price 6d., by post 7d.) can be obtained from H.M. Stationery Office.

Express Locomotives on the Paris-Lyons and Mediterranean Railway.

The P.L.M. Railway Co. has recently put into service, on the Mt. Cenis line, four electric locomotives which are said to be the most powerful single-unit locomotives built so

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far. The locomotives, which have a one-hour rating of 5,400 h.p. at the wheel rim, are capable of developing a maximum speed of 80.7 m.p.h.; they are operated with direct current at 1,500 volts.

The locomotives are equipped with six driving motors, each built as twin motors, and arranged for forced ventilation. Current is collected from the overhead lines by means of two pantographs, and from a third rail by means of four contact shoes on either side of the locomotive. All the switchgear for grouping the motors, for cutting in and out the starting resistances, and for reducing the field, as well as the main circuit-breakers in the motor circuits, are built in the form of electro-pneumatically operated contactors. There are 58 contactors in all, some operated by master controllers in the drivers' cabs and others by inter-dependent interlocking contacts.

In the event of a breakdown of any essential part, such as contactor, reverser, or starting resistances, the locomotive can still run with one-half of the equipment. Detailed descriptions of these locomotives, and of the 1,440 h.p. motor coaches supplied for the Berne-Neuchatel Railway in Switzerland, are given in Bulletin No. 101 of Messrs. Oerlikon, Ltd.

Supply Developments at Barrow.

On November 15th the Mayoress of Barrow-in-Furness, Miss M. Whinnerah, officially inaugurated extensions to the plant at the Corporation electricity works in Buccleuch Street, and also new showrooms and offices in Cavendish Street. The plant extensions include a 7,000-kW turbo-alternator, a 60,000-lb. boiler, new switchgear and various auxiliaries. The work has been carried out to the specification of Mr. H. R. Burnett, borough electrical engineer, assisted by the constructional engineer, Mr. W. Fisher. In order to accommodate the turbo-alternator in the existing building it was necessary to remove four reciprocating sets of a total capacity of 800 kW. The new set, which was supplied by the Metropolitan-Vickers Electrical Co., Ltd., as sub-contractors to Messrs. Vickers-Armstrong, Ltd., is of the two-cylinder impulse type, and provision has been made for bleeding the turbine at two stages for the purpose of feed-water heating to a temperature of 225 deg. F. The condensing plant was manufactured by Messrs. Vickers-Armstrong, and is of the contraflo kinetic type, having a cooling surface of 8,500 sq. ft.; it is capable of condensing 80,000 lb. of steam per hour. The circulating water and extraction pumps are duplicated, and are driven by squirrel-cage induction motors, which can be supplied either from the station bus-bars or from the transformer connected to the alternator terminals. Two ejector air pumps of Messrs. Vickers-Armstrong's manufacture have also been installed, and, in addition to the electrically-driven feed pumps, there is one steam turbine centrifugal feed pump of Messrs. G. & J. Weir's manufacture. The whole of the e.h.p. and l.p. switchgear and power transformers were also supplied by the Metropolitan-Vickers Electrical Co., Ltd., together with Merz-Price protective gear and a Metropolitan-Vickers automatic voltage regulator. A 25-ton electric overhead travelling crane in the engine room has been supplied by the Wharton Crane and Hoist Co., Ltd.

In order to provide accommodation for the new boiler, two of the old boilers had to be removed. The new boiler was supplied by the Stirling Boiler Co., Ltd., and the steam conditions are 200 lb. per sq. in. and 700 deg. F. The boiler is fitted with Underfeed stokers of the "L" type and "Karrena" flat arches. The economiser is of Messrs. Green's tri-tube type. A Howden-Ljungström rotary-type air heater with a heating surface of 8,000 sq. ft. has also been installed. Forced- and induced-draught fans were supplied by Messrs. Davidson and Co., Ltd., who also supplied the flue-dust collector. New coal-handling plant capable of dealing with 25 tons of coal per hour has been installed by Messrs. Naylor Bros., Ltd.

After the opening of the plant a celebration luncheon was served at the Barrow Town Hall, under the chairmanship of Alderman T. Morton, chairman of the Electricity Committee. Alderman Basterfield, J.P., gave the toast of "The Electricity Undertaking." He said the Corporation undertaking had undoubtedly been a success, and he spoke of that success not so much from the financial point of view as from the utilitarian point of view, and the people who were concerned with it deserved encouragement.

Alderman Morton, in reply, outlined the progress made by the electricity undertaking. There were 7,000 consumers connected with the undertaking, and the town clerk had modelled a hire-purchase agreement for the wiring of houses. In opening the new showroom, he was convinced that the Committee was doing the right thing.

The Mayor of Barrow, in proposing "The Contractors," referred to the giving of the contract for the turbo-alternator to the local firm of Messrs. Vickers-Armstrongs, Ltd., instead of to a Swiss firm whose price was £9,000 lower. The £9,000 supposed to be lost was more than saved by having the work done by the local firm.

Mr. J. S. Peck, representing the Metropolitan-Vickers Electrical Co., Ltd., replied for the contractors, and presented the Mayoress with a silver coffee set as a memento of the occasion. The company next went to the new showrooms and offices, where the Mayoress received a souvenir in the shape of an antique bronze table lamp, with hand panels. The new showroom premises were originally built as an ironmonger's stores. The building is a three-storey one occupying a ground space of 34 ft. by 68 ft. Extensive alterations and improvements have been carried out upon the interior of the building, in which the following accommodation has been provided: ground floor; showroom, consumers' engineer's office, and workshop. First floor; offices, lounge, and demonstration, dining, bath and bedrooms. Second floor; offices and demonstration and lecture rooms. The work was carried out under the supervision and to the specification of Mr. W. C. Persey, borough surveyor, and Mr. J. A. Charles, in collaboration with the borough electrical engineer and his staff.

The Padiham Power Station.

With a fuel consumption of 1.33 lb. of coal per unit generated and a thermal efficiency of 21.35 per cent., the Padiham power station of the Lancashire Electric Power Co. takes premier place in the Electricity Commissioners' report for the year ending 31st March, 1929. This achievement is the more remarkable as Padiham comes in the "50-100 million units generated" group of power stations, there being two groups with higher outputs, namely "100-200 million" and "over 200 million" units. Thus, Padiham ranks as the most efficient power station in Great Britain, irrespective of size and output. It is interesting to record the following figures for Padiham for the year ended March 31st, 1929, which are:—

Total number of units generated at Padiham during the year	67,043,877
Units generated by latest 15,625-kW turbo-alternator	59,925,000
(Practically 90 per cent. of the total output of the station.)	
Number of running hours during the year ...	6,057
Average load on the machine	9,893 kW.

These figures are a tribute to Mr. M. H. Adams, the resident engineer of the Lancashire Electric Power Company, his staff and the manufacturers of the plant. Although it is too early to predict the results which will be obtained at the L.E.P. Company's new super station at Kearsley, the load on the first 32,000-kW turbo-alternator having, hitherto, not exceeded 20,000 kW, the evidence is such as to justify expectations of still better results. It may be added that, in addition to the turbo-alternators, all the electrical equipment at both the Padiham and Kearsley power stations was supplied by the British Thomson-Houston Co., Ltd.

The Automobile Electrical Association.

As was briefly mentioned in our issue of November 8th, the leading firms which specialise in servicing motor-vehicle electrical equipment have just formed a new society, with the title of the "Automobile Electrical Association" to look after their special interests. Mr. E. C. Ford has been elected chairman of the provisional committee, which consists of: Messrs. A. W. Bridges, Newcastle-on-Tyne; J. J. Davis (Express Magneto (Repairs) Electrical Co., Ltd.), Yeovil; E. C. Ford (Autocar Electrical Equipment Co., Ltd.), London; J. E. Hardy, Glasgow; F. H. Jennings, Dudley; A. E. Ponton (A. E. Ponton and Sons), Bournemouth; J. E. Reilly (Reilly & Brookes), Bolton; J. Robertson (John Robertson (Belfast), Ltd.), Belfast; J. Shaw (Magneto Repairs (Leeds), Ltd.), Leeds; and E. S. R. Thorne (Thorne Bros.), Worthing. Mr. H. Scott Hall, M.I.A.E., the secretary, whose offices are at 2, Tichborne Court, High Holborn, W.C.1, has indicated that the general opinion is that membership should be confined to firms "whose business is mainly that of servicing the electrical equipment of automobiles and other electrical services, and who are not engaged in the repair of engines, chassis, or coachwork." This ruling will, as may be gathered, exclude from membership all motor garage firms, but we understand that firms specialising in the repair of dynamos and motors for lighting and power purposes are eligible.

Industrial Welfare Society.

The annual meeting of the Society was held on November 14th. The Duke of York, who presided, said that any scheme of welfare work, to be effective, must depend upon the personal enthusiasm of the head of a firm. The society was giving real service, and he could think of no movement which was doing more to promote the general well-being of industry.

Appointments Vacant.

Showroom salesman for Barrow-in-Furness Corporation. Test room supervisor and test room assistant for Hull Corporation. Plumber-jointer for Bingley Urban District Council. Assistant engineers for the Test Room and Installation Department and the Meter and Consumers' Installation Department of Sunderland Corporation. Chief station mechanic for the Government of Grenada. Plumber-jointer for the Borough of Hampstead Electricity Supply Department. (See our advertisement pages to-day.)

B.S.S. for Colliery Requisites.

In continuance of the programme of work in its colliery section, the British Engineering Standards Association has just issued specifications for underground lighting fittings and for flattened strand winding and haulage wire ropes. The underground lighting fittings specification, No. 238-1929, provides for fittings for use with British standard vacuum tungsten-filament lamps, with a minimum rating of 60 watts, and its main purpose is to ensure interchangeability of such

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parts, as well as glasses that require frequent replacement. The provisions in regard to interchangeability are also extended to cover the attachment of the cables, so that with the new standard fittings quick replacement of damaged fittings will be facilitated. The flattened strand rope specifications contain clauses regulating the testing carried out in connection with the purchase of colliery haulage and winding ropes, tensile and torsion tests of the wire being specified both before and after the manufacture of the rope.

Copies of these specifications can be obtained from the British Engineering Standards Association Publications Department, 28, Victoria Street, London, S.W.1, price 2s. 2d. each, post free.

The Association of Consulting Engineers.

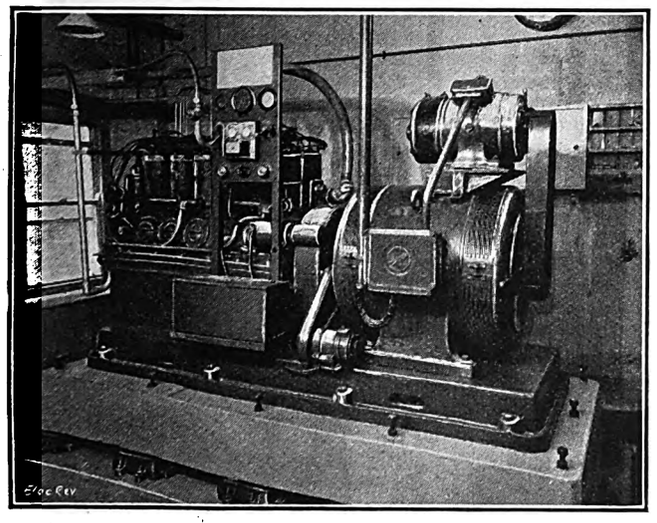
The annual dinner of the Association of Consulting Engineers (Incorporated) was held on November 13th at St. Stephen's Club, S.W. The chairman of the committee, Mr. N. G. Geyde, O.B.E., M.Inst.C.E., presided over a gathering of about 160 members and guests. Mr. S. C. Lewis, M.Inst.C.E. (hon. treas.), in proposing the toast of the High Court of Parliament, hoped that body would resume control of legislation, to which the Rt. Hon. Lord Darling, P.C., replied that whatever changes had been made in the past, Parliament had gone on much the same and he supposed would continue to go on.

Sir Thomas Robinson, C.B.E., M.P., also responded. He expressed the view that economic precedes political power. Brains still provided the driving force of the country. Round table conferences between masters and men were wanted to discuss why we could not sell the goods. The health of the guests was proposed by Mr. G. M. C. Taylor, M.C., M.Inst.C.E. Mr. Taylor named three obstructions to engineering progress: legal, financial, and sentimental, including under the latter heading most of the objections to the erection of pylons.

Response was made by the Rt. Hon. Sir John Anderson, P.C., G.C.B. (permanent under-secretary, Home Office) and by Dr. S. Z. de Ferranti, F.R.S. Sir John read an extract from the new edition of the Encyclopædia Britannica, which sets out a list of virtues which should belong to the engineer (professional). He defended the Civil Service from the charges often levelled against the bureaucracy. Dr. de Ferranti recalled how, starting as a consultant, he had been compelled to become a manufacturer owing to absence of suitable plant in those days to meet electricity supply problems. Mr. L. St. L. Pendred (vice-president of the Institution of Mechanical Engineers) in a racy speech proposed the toast of "The Association of Consulting Engineers," to which the chairman responded, giving a summary of the origin and aims of the Association.

Silent Generating Plant.

Interesting generating plant has recently been installed in the power house of the Western Union Telegraph Co. at Penzance. Being situated in the centre of a residential area, no vibration or noise of any description was permitted; a petrol engine was accordingly selected and, to make assurance doubly sure, the whole plant was mounted on special shock absorbers, which can be seen in the accompanying picture under the first concrete bed, the shock absorbers being, of course, bolted to a further concrete bed below. The engine was made by the Parsons Oil Engine Co., Ltd., and is of the standard 6-cylinder type having a bore of 4½ in. and stroke of 6 in., mounted on a heavy cast-iron bedplate and directly coupled to a special 30-kVA, 25-cycle alternator. It is fitted with electric starting equipment, including batteries and charging dynamo, and, in addition to the standard engine governor, an automatic over-speed cut-out is incorporated. The whole of the controls, including a thermometer, pressure gauge, tachometer, electric starter switch, cut-out, throttle, and ignition controls, are brought to a panel situated on the side of the plant. This was necessary in order to reduce the length of the plant to a minimum, for which reason also the exciter is driven by means of a chain and is situated on the top of the alternator. Two systems of ignition are fitted, magneto and battery and coil (timer system), and the whole plant represents a very neat lay-out to meet the special conditions involved. A very elaborate system of silencing the exhaust was originally designed, but it was found afterwards that two standard Parsons silencers in tandem was all that was necessary.



A Shock Absorber Bedplate.

Schemes for the Relief of Unemployment.

We are reminded by the Minister of Transport that on July 18th the Lord Privy Seal and the Minister of Transport met representatives of the electricity supply industry to discuss with them methods by which the amount of employment provided by the industry could be increased in order to assist the Government in dealing with the problem of unemployment. As a result of this conference the Electricity Commissioners trust that before the end of the year they will be able to report to the Ministers that they have before them evidence of a substantial increase in the activities of the industry, since they are confident that the supply industry as a whole is in a position to make an important contribution towards the solution of the problem of dealing with the unemployed.

From the Commissioners' figures it appears that the annual capital investment in transmission and distribution sytems has grown from under £8,000,000 in 1922-23 to over £16,000,000 in 1927-28. If expenditure continues to increase, as there is every reason to suppose it will, the outlay during the next five years should be over £100,000,000, and the Commissioners are of opinion that a considerable percentage of this could be accelerated so as to fall within the next two years without throwing any unreasonabe burden on the industry.

The industry is assured of a rapid and continuous growth extending over at least the next decade and, therefore, is in a position to expend capital, even in advance of immediate requirements, with certainty that any unremunerative period would be short.

The experience of the most progressive undertakings has shown that the demand for domestic supplies is such that the time has come when established undertakings operating in urban areas should now consider the practicability of completing there distributing network in the built-over areas in the next two years.

The view of the Commissioners is that it is proper to lay mains in any street in which there is a reasonable prospect that, within the next three years, the annual revenue will defray the actual additional outgoings.

The Commissioners have noted the great encouragement to the development of domestic supplies afforded by the adoption by undertakers of schemes of assisted wiring and of extended facilities for hire and hire-purchase of apparatus. They venture to urge on undertakers the initiation of such schemes wherever possible.

In many residential areas the existing mains have been laid suitable for giving lighting supplies only, and if the larger demand arising as the result of a progressive programme of development is to be met, the mains must be supplemented to render them sufficient for this purpose. The Commissioners suggest that this work is suitable to be undertaken at the present time.

The Commissioners also desire again to call the attention of undertakers to the advantages in the generality of cases of changing over from a direct current to an alternating current supply, where such a supply can be made available. As a result of the construction of the national transmission system within the next few years, supplies throughout the country generally will be given in bulk as alternating current. Any delay in starting a change of system which will ultimately be necessary, not only increases the cost thereof, but also postpones the time at which the full benefits of the National Scheme will be reaped.

The attention of undertakers is also drawn to the financial assistance for which they may be eligible under the Development (Loan Guarantees and Grants) Act, 1929, in respect of the cost of carrying out works in acceleration of normal development.

Commercial Motor Show.

CORRECTION.—In the review of the above-named exhibition (p. 881, November 15th issue) the title of the Equipment and Engineering Co., Ltd., was reversed. The error is regretted.

Mining Electrical Engineers.

The incoming chairman, Mr. S. T. Richards, A.M.I.E.E., chief electrical engineer of Amalgamated Anthracite Collieries, Ltd., in the course of an address at the first ordinary meeting of the 1929-30 session of the Western District Sub-Branch of the Association of Mining Electrical Engineers at Swansea, said the increase in the use of electricity in collieries was remarkable. In the matter of electrical accidents, the main trouble was not with the apparatus, but the education of the man operating it. There were many collieries which were shut down to-day where, if cheap power had been available, the situation would have been reversed. Mining electrical engineers had contributed their share in lowering the cost of production to meet existing conditions. Colliery plants were to-day at a higher standard of efficiency than that of many of the other industries, otherwise they would not have survived; grouping of collieries had taken place which had lent itself admirably to the centralisation of power supplies.

An E.T.B.I. Whist Drive.

A whist and bridge drive held at the Cox Café, Cardiff, on October 16th, at which eighty people were present, realised the sum of £12 4s. 4d. for the funds of the E.T.B.I.

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The Point Five Domestic Rate.

We are informed that the names of the following undertakings should be added to those given in the special supplement to the ELECTRICAL REVIEW of November 15th :—Birkenhead, Hamilton, Leigh, Sale, and Stretford, which offer tariffs including 0.5d. as a secondary charge.

Junior Institution of Engineers.

The forty-eighth sessional general meeting of the Institution was held in London on November 8th, when the annual report was presented and adopted, together with the annual accounts, which, despite certain special expenses, showed a balance of income over expenditure and a sound financial position. The ballot for officers resulted in the election of the following: *Chairman:* Stanley Dunlop; *vice-chairmen:* E. D. Gill and J. Foster Petree; *hon. treasurer* W. M. Hurrell; *hon. editor:* C. E. Atkinson; *hon. librarian:* L. H. Ardley; *senior councillors:* J. Duguid, T. C. Morewood, and L. S. Atkinson; *junior councillor:* T. Harman; *hon. auditors:* W. H. G. Churchill, T. C. Morewood, D. B. Skinner, and F. A. Glidewell.

The Electrical Association for Women.

As a result of repeated requests from members of the Electrical Association for Women for a series of practical lectures on simple repairs, the following three have been arranged to be given by Mr. H. Bourne, of the Hendon Electric Supply Co., Ltd. :—November 21st, "How Electric Heaters, Cookers and Cleaners are Wired, and why they get out of Order"; November 28th, "The Construction, Use and Maintenance of Electric Kettles, Toasters, Irons and other Small Apparatus"; December 5th, "Practical Hints about Bells, Batteries and Wireless Sets."

Members of the Birmingham and Midlands Branch of the E.A.W. spent a profitable afternoon, on November 12th, at the new works at Derby of the Macintosh Cable Co. The party saw the complete manufacture of cables for industrial and domestic wiring.

Speaking at the inaugural meeting on November 15th of the Plymouth and District Branch of the E.A.W., Viscountess Astor, M.P., said she was confident that a branch of the Association would be particularly helpful to Plymouth, which was going through an industrial revolution.

Miss Caroline Haslett, director, explained the aims and objects of the Association. She said that the old-fashioned, unhygienic methods in the home were an extraordinary feature of domestic life and she was not sure that women were altogether free from blame for it. What they wanted was an entirely new mental outlook about home work. The home was still the biggest industry in the world, and it ought to be run with efficiency and with the most up-to-date appliances that science could give them.

Mr. R. Lovell Dunstan, chairman of the City Corporation Electricity Committee, expressed his belief that the formation of a local branch of the Association would prove a very material and useful asset to the electricity undertaking.

The branch secretary, Miss M. Hollest, stated that a number of lectures and visits had already been arranged for the members.

Institution of Electrical Engineers.

INFORMAL MEETING.—At the informal meeting held on November 11th, Mr. W. E. Lang was in the chair, and Mr. W. E. Highfield opened a discussion on "Temporary Expedients in Engineering." He felt that the modern trend towards specialisation in one branch of the profession at an early age, necessarily limited the range of practical experience. He described some remarkable repairs in a variety of situations.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Our Bradford correspondent says that despite the fact that the Socialists have now a majority over both other parties on the Bradford City Council, Mr. L. JESSOP (Liberal), head of Messrs. Jessop & Boydell, Ltd., electrical contractors, has been re-elected deputy chairman of the Parks Committee; Alderman J. W. LONGLEY (Con.), consulting electrical engineer, has been re-elected chairman of the Electricity Committee; and Mr. IRVINE SMITH (Lib.), has been re-elected chairman of the Tramways Committee.

The *Australian Electrical Times* reports that Mr. J. P. DUGGAN has been appointed general manager in Australia of Messrs. Siemens Bros. (Aust.), Ltd., with head office at Sydney. Mr. H. P. SLIPPER, the general manager (then located at Melbourne), recently passed away at the early age of 45 years, after four years' illness. Before he went to Australia Mr. Slipper was with the B.T.H., at Rugby, and with Siemens Bros.' Dynamo Works at Glasgow.

The *Electrical World* reports that Mr. OWEN D. YOUNG, chairman of the board of directors of the General Electric Co. (U.S.), was presented with the Roosevelt Medal for Distinguished Service at a dinner in honour of the seventy-first birthday anniversary of Theodore Roosevelt, held on October 27th in New York.

Dr. YASUJIRO NIWA, chief engineer of the Nippon Electric Co., Ltd., of Tokio, Japan, was recently signally honoured by the Institute of Electrical Engineers of Japan, which awarded him the Asano prize for "meritorious achievement in electrical science, electrical engineering, and electrical invention." The distinction has been three times awarded in the past. The first to be honoured was Dr. H. NAGAOKA, professor at the Imperial University of Tokio. Dr. H. Ho, professor at the Imperial University of Tokio, author of extensive researches on high voltage problems, was the second recipient, while in recognition of his work on high power transmission Dr. S. BEKKU was the third to win the honour.

Mr. R. F. DIXON, for nearly ten years manager of the Mansfield & District Tramway Co., has been appointed general manager of the Oxford Motor Services, Ltd.

Mr. R. H. PALMER, of Palmer's Publicity Service, was married to Miss Muriel Cracknell at St. Martin's-in-the-Fields on November 15th. Major Clifford H. Palmer, the bridegroom's brother, acted as best man.

The marriage took place at St. George's Cathedral, Madras, on October 26th, of Mr. ROWLAND WRIGHT, assistant superintendent of the Madras Electric Supply Corporation, Ltd., and Miss Gladys Ethel Stubbs.

The marriage has taken place at Leamington of Mr. ERIC R. KNIGHT, B.Eng. (of the Leicestershire and Warwickshire Electric Power Co.), and Miss Dorothy E. Southorn, of Moreton-in-Marsh.

Councillor H. K. BEALE has been re-elected chairman of the Birmingham Corporation Electric Supply Committee.

It is announced that the Nobel Prize for Physics for 1928 has been awarded to Professor O. W. RICHARDSON, Yarrow Research Professor of the Royal Society and Director of Research in Physics at King's College, London. The award is made for Professor Richardson's formulation of the law known by his name governing the motion of electrons emitted by hot bodies. The 1929 Physics Prize goes to M. LE DUC DE BROGLIE for his researches into the movements of electrons.

A correspondent desires to get into touch with Mr. LESLIE GOSLAND, B.Sc., late of the British Electrical Industries Research Section, Colville power station, Wallsend, Northumberland.

Sir WILLIAM NOBLE, whose visit to Australia has already been mentioned, is stated in the Melbourne papers to be paying a three months' visit to the Commonwealth to study broadcasting, telegraph, and telephone developments. He is also inspecting the automatic telephone system just installed at Hobart for the Government by his company, the General Electric Co., Ltd.

Herr L. V. VEREBELY, chief electrical engineer of the Hungarian State Railways, has been appointed Professor of Electrotechnics at the Technical High School of Budapest. He will continue to act as advisory engineer to the State Railways on electrification questions.

To fill vacancies caused by the death of Sir John Gatti and the resignation of Mr. Herbert Morrison, Minister of Transport, the Special Committee on Traffic of the L.C.C. recommends the appointment of Mr. W. H. GREEN and Mr. CHARLES W. MATTHEWS as members.

Obituary.—Mr. J. W. LIEB.—Mr. John William Lieb, senior vice-president of the New York Edison Company, and a pioneer of the American electric light and power industry, died on November 1st, at New York, after an illness of several months. His death was mentioned in our reference to the late Signor Guido Semenza last week. Mr. Lieb was born in 1860. He was an associate of Mr. Thomas A. Edison in designing and installing equipment for Pearl Street Station, in New York City, which was put into operation on September 4th, 1882. He obtained a degree as mechanical engineer in 1880 and in the same year began his employment with the Brush Electric Co., of Cleveland, Ohio, as draughtsman. He devoted the whole of his business life to the electrical industry. In November, 1882, he was selected by Mr. Edison to go to Milan, Italy, to direct the installation of the Milan Edison station. On the organisation of the Società Generale Italiana di Elettricita, Sistema Edison, he was appointed its chief electrician, then chief engineer, and finally technical manager and director

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of stations. The Milan station was started in regular service in March, 1883. In 1893, there was put into service, under Mr. Lieb's direction, in Milan, one of the earliest trolley systems in Italy. For his pioneer work in connection with the introduction of electric light and power service throughout Italy and the installation of the electric trolley system in Milan, he was decorated by the Italian Government Knight Commander of the Royal Order of the Crown of Italy, and was later promoted to Grand Officer. In 1925 he was made "Ufficiale" of the Order of S.S. Maurizio e Lazzaro, and in 1928 was honoured by the French Government, receiving the decoration of Officer of the Legion of Honour. In 1894, Mr. Lieb returned to America and engaged in manifold electrical activities, and duly became a member of innumerable engineering and scientific institutions in the United States and Europe.

Signor E. Razzoli.—The death is reported from Catania, Sicily, at the age of 70 years, of Signor Emilio Razzoli, a well-known Italian electrical engineer. The deceased was for some years chief engineer of the municipal electricity supply undertaking in Milan, and later consulting engineer of the Società Generale Electrica della Sicilia.

Mr. G. W. Carpenter.—Mr. Gilbert W. Carpenter, assistant manager of the Scarborough Corporation electricity undertaking, died last week at Scarborough, aged 50 years. He was present three days before his death at a meeting in connection with the dispute between the Scarborough Electricity Committee and the Electrical Power Engineers' Association. He had been in ill-health for some time.

Mr. F. J. Mudford.—We regret to record the death which occurred on November 13th, after a brief illness, of Mr. Francis John Mudford, M.I.E.E., of Arrow Electrical Works, Jackson Road, Holloway, N.7. Mr. Mudford who was 72 years of age became an associate of the Institution 48 years ago (1881) and a full member in 1891.

Mr. E. L. Fleming.—The *Devon Gazette* reports the death, on November 9th, of Mr. E. L. Fleming at the age of 75. Mr. Fleming, who was a brother of Professor Sir J. A. Fleming, is said to have been the originator of the scheme for producing electricity by means of the tidal power of the River Exe.

Wills.—Mr. Walter Scott, at one time chairman of the Rochdale Electric Co., and a newspaper proprietor and printer, left £105,578 gross and £94,038 net personalty.

The Times records that the late Mr. H. T. Schiassi, of Vevey, Switzerland, who was for over 34 years contract engineer to Callender's Cable and Construction Co., Ltd., left £10,430 net personalty.

Mr. A. C. Jones, of Messenger & Sons, electric light and gas fittings manufacturers, left £167,625 gross and £115,786 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Chas. Preston & Co., Ltd.—Private company. Registered November 13th. Capital, £3,500 in £1 shares. Objects:—To acquire the business carried on by L. St. Alphonse as Chas. Preston & Co., and to carry on the business of agents for and factors of electrical, wireless, and builders' appliances, fittings and accessories, &c. The first directors are:—L. St. Alphonse, 51, Baronet Road, N.17, merchant (director of Electrical Engineers, Ltd.); W. R. Curtis, 23, Coniston Road, Muswell Hill, N.10, electrical salesman; E. G. B. Carrs, 14, Ridge Road, Winchmore Hill, N.21. Qualification, 500 shares. Registered office: 41, Berners Street, W.1.

Standard Switchgear, Ltd.—Private company. Registered November 14th. Capital £1,000 in £1 shares. Objects: To carry on the business of marketers of electric lighting, cooking, heating, power and all other kinds of electrical fittings and equipment, &c. The directors are: J. B. Rudkin, (managing director), "Mount Joy," Hill View Road, Rayleigh, Essex; Mrs. Violet G. Rudkin, "Mount Joy," Hill View Road, Rayleigh, Essex. Qualification: £100 shares. Secretary: Ellen M. Rudkin.

Vul-K-Lec, Ltd.—Private company. Registered November 12th. Capital £1,000 in £1 shares. Objects: To acquire the business of electric vulcaniser manufacturers and suppliers carried on by B. Griffith, H. de Lisle Crawford and W. H. Fawcett at 58, South John Street, Liverpool. The directors are: B. Griffiths, 31, Cromer Drive, Wallasey; H. de Lisle Crawford, 3, Rodney Street, Liverpool; W. H. Fawcett, 59, Donaldson Street, Liverpool. Qualification: £100 shares. Registered Office: 58, South John Street, Liverpool.

British Universal Illuminations, Ltd.—Private company. Registered November 13th. Capital £100 in 1s. shares. Objects: To acquire the business of the British Illuminations Company and H. Stanley Smith & Co., electrical contractors, and to carry on this and the business of electrical installation and illuminating contractors, &c. The first directors are:—H. S. Smith, 61, Southwater Road, St. Leonards-on-Sea, electrical contractor; W. A. Leer, 31, Quebec Street, W.1, electrical salesman; A. L. Williams, 33, Tower Road, St. Leonards-on-Sea, sales manager (electrical goods). The first two are joint managing directors.

Armaflex Parent, Ltd.—Registered as a private company November 18th. Capital, £25,000 in 22,500 8 per cent. preference shares of £1 each and 50,000 ordinary shares of 1s. each. Objects:—To acquire from the Relative Engineering Co. the patent rights under the provisional No. 2,046/29 for improvements in or relating to cable making and light machines in the name of F. J. Humphrey and to carry on the business of cable manufacture, engineers, metal and wood workers, &c. The directors are:—Brig.-Gen. Sir Wm. T. F. Horwood, G.B.E., K.C.B., D.S.O., 5, Powis Terrace, W.11 (director Philips Lamps (England), Ltd.); J. Neale, 15, Acacia Road, St. John's Wood, N.W.; C. L. F. Clutterbuck, 17, St. James's Avenue, Brighton; A W Torry, F.L.A.A., 27, Dundonald Drive, Leigh-on-Sea (director Relative Engineering Co., Ltd.); F. J. Humphrey, 9, Woodford Road, Forest Gate, E. (director Relative Engineering Co., Ltd.). Secretary: J. Culverwell. Registered office: 27, Queen Victoria Street, E.C.4.

Official Returns of Electrical Companies.

P. N. Forbes, Ltd.—W. G. Grosvenor-Launder, Northend, Henley-on-Thames, ceased to act as receiver or manager on April 9th, 1929. (Notice filed November 9th.)

Electrical Finance & Securities Co., Ltd.—Satisfaction to the extent of £2,080 (making total redeemed £4,100) on November 1st, 1929, of trust deeds to secure debenture stock authorised by resolutions of the board dated April 28th, 1927, and May 3rd, 1928, and resolution of the company dated May 6th, 1927, registered on July 29th, 1927, and July 10th, 1928.

Wolf & Morgan, Ltd. (former Wagner Electric Supplies, Ltd.). Particulars filed of £2,000 debentures authorised October 23rd, 1929, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £1,000.

City Wireless Co., Ltd.—Capital, £100 in £1 shares. Return dated June 28th, 1929. 52 shares taken up. £52 paid. Mortgages and charges, £500.

H. E. Keen & Co., Ltd.—Capital, £6,000 in £1 shares. Return dated June 26th, 1929. All shares taken up. £502 paid. £5,498 considered as paid. Mortgages and charges, nil.

Magnetic Separators, Ltd.—Capital, £500 in £1 shares. Return dated May 7th, 1929. All shares taken up. £500 paid. Mortgages and charges, £600.

Fraser Mares, Ltd.—Capital, £1,500 in £1 shares. Return dated August 9th, 1929. 1,080 shares taken up. £1,080 paid. Mortgages and charges: £600.

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Bennett & Fountain, Ltd.—Capital, £3,000 in £1 shares. Return dated January 30th (filed June 4th), 1929. 2,000 shares taken up. £1,000 paid. £1,000 considered as paid. Mortgages and charges, nil.

Geo, Bray & Co., Ltd.—Capital, £160,000 in 80,000 preference and 80,000 ordinary shares of £1 each. Return dated May 14th, 1929. 55,000 preference and 55,000 ordinary shares taken up. £7 paid. £109,993 considered as paid. Mortgages and charges, £40,000.

Shoreham & District Electric Lighting & Power Co., Ltd.—Capital £27,500 in £1 shares. Return dated April 25th,1929. 17,329 shares taken up. £10,829 paid. £6,500 considered as paid. Mortgages and charges at date of return, £16,200. Issued October 1st, 1929: £1,300 6 per cent. ten-year notes.

Colombo Electric Tramways & Lighting Co., Ltd.—Capital £150,000 in £10 shares. Return dated June 11th, 1929. 13,084 shares taken up. £840 paid. £130,000 considered as paid. Mortgages and charges, nil.

Sheerness & District Electric Supply Co., Ltd.—Capital, £75,000 in £1 shares. Return dated May 28th, 1929. All shares taken up. £75,000 paid. Mortgages and charges, nil.

Hendon Electric Supply Co., Ltd.—Capital, £250,000 in 150,000 preference, 96,095 ordinary and 3,905 unissued shares of £1 each. Return dated April 4th, 1929. 96,095 ordinary and 150,000 preference shares taken up. £223,930 paid on 150,000 preference and 73,930 ordinary shares. £22,165 considered as paid on 22,165 ordinary shares. Mortgages and charges: £200,000.

Walters Electrical Manufacturing Co., Ltd.—Capital, £18,000 in £1 shares. Return dated June 27th, 1929. 16,875 shares taken up. £6,875 paid. £10,000 considered as paid. Mortgages and charges, nil.

Pope's Electric Lamp Co., Ltd.—Capital, £25,100 in 25,000 preference and 100 ordinary shares of £1 each. Return dated July 24th, 1929. 23,579 preference and 100 ordinary shares taken up. £5,254 paid. £18,425 considered as paid. Mortgages and charges, nil.

Dawlish Electric Light & Power Co., Ltd.—Capital, £20,000 in £1 shares Return dated July 4th, 1929. All shares taken up. £20,000 paid. Mortgages and charges: £2,750.

Electric Construction Co., Ltd.—Capital, £400,000 in 100,000 preference and 300,000 ordinary shares of £1 each. Return dated July 2nd, 1929. 62,780 preference and 300,000 ordinary shares taken up. £116,490 paid on 36,490 preference and 80,000 ordinary shares. £246,290 considered as paid on 26,290 preference and 220,000 ordinary shares. Mortgages and charges: £122,530.

Howard Asphalt Troughing Co., Ltd. (formerly Howard Conduit Co., Ltd.).—Capital, £20,000 in 19,000 ordinary and 1,000 deferred shares of £1 each. Return dated June 4th, 1929. 5,007 ordinary and 1,000 deferred shares taken up. £4,007 paid. £2,000 considered as paid. Mortgages and charges, nil.

Yorkshire Switchgear and Engineering Co., Ltd.—Capital, £10,000 in £1 shares. Return dated May 21st, 1929. 5,382 shares taken up. £2,382 paid. £3,000 considered as paid. Mortgages and charges, £3,922 5s.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Capital, £8,100,000 in 1,500,000 7 per cent cum. preference, 2,500,000 5 per cent. preference, and 4,100,000 ordinary shares of £1 each. Return dated April 9th, 1929. 1,500,000 7 per cent. preference, 1,538,952 5 per cent. preference, and 4,007,681 ordinary shares taken up. £6,088,123 10s. paid on 1,500,000 7 per cent. preference, 730,555 5 per cent. preference, and 3,857,645 ordinary shares, leaving £76 10s. in arrears. £958,433 considered as paid on 808,397 5 per cent. preference, and 150,036 ordinary shares. Mortgages and charges, £4,296,458.

Kidderminster and District Electric Lighting and Traction Co., Ltd.—Capital, £100,000 in 5,000 preference and 5,000 ordinary shares of £10 each. Return dated August 6th, 1929. 5,000 preference and 4,700 ordinary shares taken up. £97,000 paid. Mortgages and charges, nil.

Alton District Electricity Co., Ltd.—Capital, £5,000 in £1 shares. Return dated June 26th, 1929. All shares taken up. £5,000 paid. Mortgages and charges, nil.

Sunray, Ltd.—Capital, £2,000 in £1 shares. Return dated May 16th, 1929. All shares taken up. £2,000 paid. Mortgages and charges, nil.

Barron & Co., Ltd.—Capital, £5,000 in £1 shares. Return dated May 23rd, 1929. 1,619 shares taken up. £19 paid. £1,600 considered as paid. Mortgages and charges, nil.

Tudor Accumulator Co., Ltd.—Capital, £100,000 in 8,800 "A" and 1,200 "B" shares of £10 each. Return dated April 8th, 1929. All shares taken up. £29,000 paid (being £10 per share on 2,600 "A" and £2 10s. per share on 1,200 "A" shares). £71,000 considered as paid (being £10 per share on 5,000 "A" and 1,200 "B" and £7 10s. per share on 1,200 "A" shares). Mortgages and charges, nil.

Standard Electric Co., Ltd.—Capital, £10,000 in 5,000 preference and 5,000 ordinary shares of £1 each. Return dated June 14th, 1929. 3,077 preference and 5,000 ordinary shares taken up. £4,377 paid. £3,700 considered as paid. Mortgages and charges, £300.

Standard Telephones & Cables, Ltd.—Capital, £2,000,000 in £1 shares. Return dated July 16th, 1929. All shares taken up. £906,000 paid. £1,094,000 considered as paid. Mortgages and charges, nil.

Yesly Electrical Supplies, Ltd.—Capital, £1,000 in 500 "A" and 500 "B" shares of £1 each. Return dated July 1st, 1929. 150 "A" and 401 "B" shares taken up. £551 paid. Mortgages and charges nil.

East Cornwall Electricity Supply Co., Ltd.—Satisfaction in full on October 18th, 1929, of debenture dated February 27th, 1926, securing all moneys due or to become due from the company to Lloyd's Bank, Ltd.

Wadebridge and District Electric Supply Co., Ltd.—Satisfaction in full on July 11th, 1929, of debentures dated February 1st, 1923, securing £1,500, of which only £500 was issued.

Malmesbury Electric Supply Co., Ltd.—Capital, £6,000 in 3,000 preference and 3,000 ordinary shares of £1 each. Return dated June 28th, 1929. 1,945 preference and 2,800 ordinary shares taken up. £4,745 paid. Mortgages and charges, nil.

City Notes.

Radiovisor Parent, Ltd.

The first annual general meeting of this company was held on November 15th, Lieut.-Col. The Hon. A. C. Murray presiding. The chairman said that the company was in a strong financial position, having cash resources amounting to over £113,000. One of the most remarkable technical developments of recent years had been the use of light-sensitive processes for various applications, especially in connection with talking films. The advent of the Radiovisor light sensitive bridge had placed the selenium cell in the forefront of light-sensitive devices. Having such a selenium bridge a large field of activity was opened up and the possible applications were numerous. It was not the board's policy to go in for manufacturing apparatus on a large scale other than the Radiovisor light sensitive bridge, and they were prepared to co-operate with manufacturers and make arrangements with them to take over the manufacture and sale of appropriate applications. In cases where firms or individuals wished to make use of the bridge for some particular purpose or application of their own it was the policy to lend bridges and to assist them in developing their ideas. The patent rights and trade marks for the world, excepting Great Britain, Northern Ireland, the Isle of Man, and the Irish Free State, had been sold to Radiovisor Foreign & Colonial, Ltd., in which the parent company held a substantial interest. The foreign company had already made considerable progress, having concluded an agreement with Siemens & Halske A.G., of Berlin, for the exclusive rights to manufacture and sell throughout Europe. Intensive development work was already being carried out in their laboratories and workshops, which should lead to active business. The report and accounts were adopted.

India Rubber, Gutta Percha, and Telegraph Works Co., Ltd.

The directors' report for the year ended August 31st last shows a profit of £22,828, to which is added £42,655 brought forward, making a total of £65,483. From this is deducted the dividend on preference shares paid in January and July, leaving a balance of £52,983. The directors recommend a dividend of 2½ per cent., free of tax, on the ordinary shares, leaving £34,233 to be carried forward. The report states that a marked recovery has taken place at Persan both as regards profits and turnover. The new steam and power plant at Silvertown is practically completed, and its installation will materially reduce expenses in the future.

Although the accounts show an improvement on last year, the trading profits have not improved correspondingly. The turnover is less than last year, although the actual output is well maintained. The directors fully realise that increased profits are now dependent mainly upon larger sales, and their most serious attention is being given to this problem.

Buell Combustion Co., Ltd.

The second annual meeting of this company was held on November 6th, Mr. J. W. Murray (chairman) presiding. In presenting the report and accounts, the chairman said that the profit and loss account showed a further debit of £10,431, which was largely accounted for by the cost of redesigning and reconditioning old plant and the drastic writing off of obsolete stock, &c. The position of the company had materially improved since the last annual meeting, and interest in the use of pulverised coal had been steadily increasing. He looked forward with optimism to the future of their interests under the management of the Howden-Buell Co. The report and accounts were adopted.

Beaver Trust, Ltd.

Addressing the annual meeting of the company on November 14th, Mr. J. G. P. Stone (chairman) said since the previous balance sheet was issued the outstanding call of 12s. 6d. per share on the then recently issued 100,000 shares had been

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paid up, and subsequently the approved scheme for the sub-division of the capital into preference and ordinary shares was carried through. The whole of the capital, with the proceeds of the £150,000 debenture stock, had been invested. An analysis of investments showed that 28 per cent. was invested in electricity supply companies. The report and accounts were adopted.

Stock Exchange Notices.

Dealings in the following have been allowed by the Committee under Rule 159:—

Atlas Light & Power Co.—£467 5 per cent. debenture stock.

County of London Electric Supply Co.—217,050 ordinary shares of £1 each, fully paid, Nos. 6,603,335 to 6,820,384.

Electrical Finance & Securities Co.—23,838 ordinary shares of £1 each, fully paid, Nos. 76,163 to 100,000; £2,700 5½ per cent. debenture stock.

Underground Electric Railways Co. of London.—7,988 ordinary shares of £1 each, fully paid, Nos. 7,267,080 to 7,275,067.

Erinoid, Ltd.

Presiding at the recent annual meeting, Mr. A. Binnie said that during the first half of the financial year there was a decrease in sales owing to the prolonged winter. It was not possible to get shipments to the North of Europe delivered, as the ports were frostbound and the railways blocked by snow. There was an improvement in the latter half of the year, however, and the total for the twelve months was rather in excess of that of the previous year. The considered view of the board was that it was better to discontinue the interim dividend for the present, but to issue a half-yearly report. The report and accounts were adopted.

Liskeard (Cornwall) Gas and Electricity Co., Ltd.

Presiding at the annual meeting on November 15th, the chairman (Mr. W. H. Huddy) said that after writing off £1,400 for depreciation, and paying for heavy repairs and renovations to plant out of current revenue, a profit had been made on the year of £1,215. He stated that the consumption of electricity in Liskeard had increased by 25 per cent. during the year. A dividend of 7½ per cent. was declared on the ordinary shares.

Metals Coating Co., Ltd.

This company has issued, for information only, particulars of its registration and objects. Its capital is £150,000 in 5s. shares. It proposes to acquire a factory at Dudley to work the metal-coating process briefly described in our issue of October 25th, 1929, p. 708, which process, according to a prospectus before us, is employed by a large number of electrical manufacturing concerns in this country and abroad.

Indo-European Telegraph Co., Ltd.

The shareholders have been informed that the board has practically concluded arrangements with Imperial & International Communications, Ltd., under which an offer by that company to purchase the shares of the Indo-European Telegraph Co. at the price of £55 per share should be made in the near future.

Melbourne Electric Supply Co., Ltd.

Subject to confirmation at the annual general meeting it is proposed to pay the usual final dividend on consolidated ordinary stock of 5 per cent. actual, making 10 per cent., free of tax, for the year ended August 31st last.

Bolckow, Vaughan & Co., Ltd.

At meetings of the 5 per cent. cumulative preference shareholders and ordinary shareholders on November 12th, proposals for the amalgamation of the company with Dorman, Long and Co., Ltd., were approved.

Para Electric Railways and Lighting Co., Ltd.

A dividend on the 6 per cent. cumulative preference shares at the rate of 3 per cent., less tax, has been declared on account of the year ending November 30th next.

British Thomson-Houston Co., Ltd.

The directors have decided to pay a dividend on the 7 per cent. cumulative preference shares for the half-year ending December 15th, less tax at 4s.

Montreal Light, Heat and Power Consolidated.

A dividend on common shares of 60 cents per share for the quarter ending December 31st, less tax, at 4s., has been declared.

Madras Electric Supply Corporation, Ltd.

An interim dividend of 2½ per cent., tax free, has been declared on the ordinary shares, as last year.

French Companies.

The *Société Française Radioelectrique* records a net profit of 3,459,000 fr. for 1928-29, as compared with 2,026,000 fr. in the preceding year.

The *Société de Constructions Electriques de Nancy* has decided to increase the rate of dividend from 9 per cent, in 1927-28 to 11 per cent. for 1928-29, the net profits having been 755,000 fr. and 933,000 fr. in the two years, respectively.

The *Société d'Electro-Metallurgie de Dives* reports net profits of 35,558,000 fr. for 1928-29, rising to 47,697,000 fr. with the balance brought forward. It has been decided to pay a dividend of 135 fr. per share and to carry 23,342,000 fr. forward.

Stocks and Shares.

Tuesday Evening.

The New York Stock Exchange has stepped in officially to do what it can in order to mitigate the disasters that have befallen so many speculators, and also real investors, in the United States, by reason of the slump, and the panic which followed it, in Wall Street just lately. One slump was succeeded by another with a rapidity almost bewildering, and it was this blow upon blow which demoralised the market, for in most movements of similar kind, the severity of a slump can be measured by the abruptness of the recovery that follows. The New York Federal Bank reduced its rate, and there is talk of the Bank of England following this example. The New York Stock Exchange is closing once more this week at one o'clock each day, and altogether on Saturday. The President of the Republic, together with some of the other Government officials, are taking steps to alleviate the distress caused in America by the result of the over-speculation which rushed up prices to absurd levels. The upshot of it all is that a good many rallies have occurred, and prices are generally steadier. From the lowest levels touched, there has been a substantial improvement. Utility stocks and shares, in which the recent fall has been most pronounced, are better with the rest. That everything is not yet well can be judged from the restlessness that prevails in Brussels, Amsterdam, and some of the other Continental centres. The Stock Exchange will soon be talking about the advent of the Christmas holidays as being a cause for quietude of business. Certainly the present week has contributed but little more than bread-and-butter business, though it is something to the good to have the atmosphere a little clearer, and to observe that confidence is returning by slow degrees.

Home Railway Market.

One of the stocks which suffered severely in the recent slump was Metropolitan consolidated, which fell to 57½ at one time. It regained a couple of points in a single day, and has since advanced to 60½. The flatness was due to the necessity for stock being sold in order to provide money for the meeting of obligations incurred elsewhere. The strike of 'busmen turned out to be a small affair, and Underground Electric income bonds, together with the shares, which had been put down sharply by reason of the labour trouble, had no difficulty in recovering their previous positions. Districts are a point lower at 72. The result of the new five per cent. conversion issue, the price of the scrip being now about par, has had no effect upon the gilt-edged securities of the Home Railway market. Prior-charge stocks retain their previous levels, and scarcity of supply begins to make itself felt as a market factor.

Electricity Supply Shares Fall.

Heavy falls took place in some of the principal of the home electricity supply companies' shares. Bournemouth & Poole have shed 3s. 9d. to 56s. 3d., Scottish Power 1s. 6d. to 28s. 6d., and Clyde Valleys ½ to 1¾. Urban ordinary are a florin down at 35s. The chief weakness amongst London shares is that in County of London ordinary, a fall of 2s. 3d., reducing the price to 48s. 3d. Metropolitan added to their 5s. loss, of last week, a further drop of 2s. 6d. reducing the price to 36s. 3d. The new shares, offered at 30s., gave way at one time to 1s. 9d. premium, as against the opening price of 8s. premium when the market started. Later there was a recovery to 4s. 9d. premium. The new Midland Counties are quoted about 3d. premium, and Scottish Power new shares, at 27s. 9d. Isle of Thanet ordinary, at 31s., show a fall of 3s. 6d.; Northamptons, which were 47s. last week, have been down to 37s., and this—Tuesday—evening stand at 42s. The main cause of the heaviness lies in the impression that if America has lost more money than she can afford over utility and railroad shares, she will be unable to implement the various schemes which, according to rumour, have been in the air for some time past, and in which the names of County of London, Northampton, Isle of Thanet, and several others were mentioned. Shares in any of the companies of which Americans have recently been credited with a desire to obtain control, and whose shares have been bought, presumably, for this purpose, appear to be the principal centres of weakness. At the end of the last and at the beginning of the present week, however, a better tendency supervened. Provincial shares suffered more than those of the London group, the reason being that, as there was greater scope for movement in the former,

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prices had been put up more vigorously than those of the latter. Atlas ordinary are 9d. up at 27s. 3d. British Power and Light dipped to 13s. before rallying to 14s. They look reasonably cheap as a speculative investment.

Dollar Stocks.

After the extraordinary falls which occurred earlier in the month in the stock and shares of American utility companies, the movements during the past few days may be considered almost insignificant. Montreal Light, Heat, & Power, for instance, at 115½, are no more than 4½ down. Pennsylvanias fell from 80 to 70, but have since recovered to 80½, showing a gain on the week of half a dollar. Power Corporation of Canada, at 77½, are 5½ down. American Telephone & Telegraph rose 12 to 227, which goes against 245 a fortnight ago. International Telephone & Telegraph, at 70, are 5 points lower on the week. Shawinigan, at 75½, show a drop of 3½. Brazilian Tractions, in which there continues to be a very active market, gained 3 points at 42, but the preference fell 5 to 135. Hydro-Electrics have come up from 32 to 34½, though a day or two earlier the price was 37. Mexican Light & Power common shares are a further 5 points lower at 75. The movements are irregular, it will be observed, reflecting in all probability the position of the speculative account as it has prevailed in New York; that is to say, if there were a big bull position in any of these stocks, the price would have to give way more sharply than in others to which the speculator had been paying less attention.

Further Declines.

British Electric Traction came down from its last week's price of 1,325 to about 1,200, from which latter figure there was a recovery to 1,250, leaving a fall on the week of 75 points, which is only half the drop shown by the previous week's quotation. London & Suburban Traction preference are lower at 9s., but the market in a good many of the less active stocks and shares has become so quiescent as to be nearly nominal. Hastings & District Electric Trams 5 per cent. debenture is marked down from 47½ to 26½, a drop of 21 points. Perak Hydro-Electrics weakened to 12s. 6d., and the debenture to 105½. Melbourne Electric ordinary stock gave way to 170. Calcutta Electrics weakened to 52s.

Indo-Europeans' Big Rise.

Cables and Wireless stocks have again fallen, and fairly heavily. The company's "B" ordinary, which stood at 100 early in July, has been down to 35 during the past few days. At the latter level, buyers are attracted by the speculative possibilities, and the price recovered to 42½. A good deal of business has been going on in the company's 7½ per cent. "A" ordinary stock, the net change on the week being a fall of 2 at 79½. The 5½ per cent. preference weakened to 96½, in spite of the easier tendency of the money market and the corresponding improvement that this brought about in the stocks of sound investment character. Anglo-American preferred rose a point to 99½. The principal feature in this market, apart from the pyrotechnics in Cables & Wireless deferred, is a rise of 7½ in Indo-European shares, this lifting the price to 55. The company has received an offer to sell its shares at this figure, and presumably holders will be glad to hand over their interests at such a price. The highest reached this year was 57, and the lowest 45, while last year the respective figures were 48½ and 30. The company has been paying 10 per cent. dividends, tax free, on its shares, which are of the unusual nominal value of £25 each. Globe Telegraph and Trust ordinary weakened to 23, because of the fall in Cables & Wireless stocks. The preference remain unchanged at 10½. Marconi Marines have receded to 2 1/16. Telephone Manufacturing dropped to 3s. 6d. International Automatic Telephones remained at 35s., and Automatic Telephones, although quoted officially at 37s. 6d., are not actually as good as this in the market. Postal Telegraph 5 per cent. debenture remains at 87.

The Manufacturing Group.

Shares in the manufacturing companies are again disposed to be lower, though Callenders stand out as a bright exception at 3¾. This shows a gain of 2s. 6d. A similar fraction has been lost by British Insulated ordinary at 3¾, while Johnson and Phillips are 3s. 9d. down at 35s. Henleys fell back to 5⅝, being 5s. down. British Aluminium lost 1s. 9d. at 44s. 6d. Siemens at 27s. 6d. are unaffected by the interim dividend of 2½ per cent. The India-Rubber, Gutta-Percha Company made a profit in the year ended August 31st, 1928, of £236, while for the twelve months ended August this year, the profit came to £22,800. A great deal of this has been saved from expenses. In the report, the directors point out that the new plant at Silvertown is practically completed, and that its installation will materially reduce future expenses. The price of the shares remains unchanged at 11s. 3d. The highest price touched this year and last year was 17s. 6d. In both of these periods it has been down to 10s. 3d. The 5 per cent. debenture at 90½ shows a gain of a point. A fair amount of animation characterises Associated Electrical Industries ordinary, where the price of 29s. 6d. shows a fall on the week of 3s. General Electrics, on the other hand, at 45s., are 1/16 higher. Iron and Steel shares lean to the easier side, with Babcock & Wilcox 1/16 down at 58s. 9d. Vickers keep about 7s. 10½d. The rubber share market is slightly less heavy upon a faint recovery in the price of the produce.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom.	Approx. Dividend.		Price Nov. 19	Rise or fall	Yield
	£	1927.	1928.	1929.		p.c.
Bournemouth and Poole	1	15	15	56/3	—8/9	5 6 9
Brompton Ordinary	1	8½	8½	26/-	—	5 7 8
Charing Cross Ordinary	1	8½	8½	26/6	—	5 5 8
do. do. 4½% Pref. ...	1	4½	4½	17/-	—	5 6 0
Chelsea	1	8¾	8¾	25/-	—	5 12 0
City of London	1	10	10	32/-	—	4 7 6
do. do. 6% Pref....	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	1⅞	—⅛	... ...
County of London	1	7	10	48/3	—2/3	4 3 4
do. do. 6% Pref....	1	6	6	22/6	—	5 6 8
Edmundson's 7% Pref.	1	7	7	24/-	—	5 16 8
Elec. Supply Corporation	1	11	11	48/3	—3/16	4 11 8
Kensington Ordinary	1	8	8	26/-	—	5 7 8
Lancs. Light and Power	1	7½	7½	28/-	—	5 7 2
London Electric	1	8½	9	27/-	—6d.	5 1 10
Metropolitan	1	9	9	36/3xr	—⅛	4 19 4
do. 4½% Pref.	1	4½	4½	17/-	—	5 6 0
Midland Counties	1	6½	6½	27/-	—1/-	4 16 4
Mid. Elec. Power	1	15	8	33/9	—9d.	4 14 10
Newcastle-on-Tyne Ordinary ...	1	6	6	23/9	—9d.	5 1 1
do. 7% Pref.	1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	10	6	6	11	—	5 9 1
North Met. Elec. 6% Pref.	1	6	6	22/-	+6d	5 9 1
St. James' and Pall Mall	1	8	8	26/-	—6d.	5 7 8
Scottish Power	1	8	8	28/6	—1/6	5 12 8
South London	1	8½	8½	26/6	—	5 5 8
Urban Ordinary	1	7	7	35/-	—2/-	4 0 0
Westminster Ordinary	1	8½	8½	25/6	—	5 9 10
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	23/6	—	6 7 8
Yorkshire Elec.	1	8	8	32/-	—1/6	5 0 0

HOME RAILS.

Central London Ord. Assented ...	Stock	4	4	71	—	5 12 8
Metropolitan	,	8	8½	60½	+½	5 15 8
do. District	,,	4	5	72	—1	6 19 0
Underground Electric	£1	5	7	32/-	+1/-	6 7 8
do. do. Income ...	Bonds	6	6	105	+8	5 14 8

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	99½	+1	6 0 7
do. Def.	,,	1½	1½	24¾	—	6 4 5
Automatic Telephone	1	10	12½	87/6	—	6 13 4
Cables & Wireless 5½ Pref.	Stock	—	—	96½	—1	5 14 0
do. A 7½ Ord.	,,	—	—	79½	—2	... ...
do. B Ord.	,,	—	—	42½	—5	... ...
Globe Tel. and T. Ord.	10	10	10	23	—¼	*4 7 0
do. do. Pref.	10	6	6	10⅝	—	5 9 1
Great Northern Tel.	10	20	17½	29	—	6 0 9
Indo-European	25	10	10	55	+7½	*3 12 9
Marconi-Marine	1	12½	15	2 1/16	—1/16	... ...
Oriental Telephone Ord	1	12	12	2 1/16	—	... ...

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	8 1/16	—	8 19 6
do. do. 2nd Pref. ...	5	6	6	8 1/16	—	9 16 0
do. do. 5% Deb. ...	Stock	5	5	75	—	6 13 4
British Electric Traction Def. Ord.	,,	5	5	1250	—75	... ...
do. do. Pref. Ord.	,,	8	8	124½	—	6 8 6
Brazil Traction	100	7	8	42	+3	4 15 3
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	86½	—	5 15 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	9/-	—6d.	... ...
London United Tram Deb. ...	Stock	4	4	51½	—	7 15 4
Mexico Trams, 5% Bonds	—	5	5	65	—	7 12
Mexican Light Common	100	Nil	Nil	75	—5	... ...
do. 7% Pref.	100	7	7	77½	—	9 0 8
do. 1st Bonds	—	5	5	77½	—	6 9 0
Yorkshire (West Riding)		Nil	Nil	5/-	—	... ...

MANUFACTURING COMPANIES.

Assoc. Elec. Ord.	1	6	—	29/6	—8/-	4 1 4
Babcock & Wilcox	1	18	15	58/9	—3/16	*5 2 0
British Aluminium Ord.	1	10	10	44/6	—1/9	*4 10 5
British Elec. Transformer Pref. ...	1	7	7	18/-	—	... ...
British Insulated Ord.	1	15	15	8¾	—⅛	4 0 0
Brush Ord.	Stock	10	10	126½	—	7 18 1
Callenders	1	15	15	3¾	+⅛	4 0 0
do. 6½% Pref.	1	6½	6½	1¼	—	5 4 0
Crompton Parkinson Ord.	5/-	—	80	20/6	—	7 6 6
do. 8% Pref.	1	8	8	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	7 1 2
do. 5% Deb.	Stock	5	5	84½	—	5 18 4
Electric Construction	1	7½	5½	15/-	—	7 6 8
Enfield Cable Ord.	1	20	20	4¾	—⅛	4 4 5
English Electric	1	Nil	Nil	7/6	—	... ...
do. do. Pref.	1	8	Nil	8/9	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
do. Ord.	1	10	10	2½	+1/16	4 9 0
Henley	1	25	30	5⅝	—¼	5 6 9
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	Nil	Nil	11/3	—	... ...
Johnson & Phillips	1	10	—	35/-	—3/16	5 14 3
Siemens Ord.	1	7½	7½	27/6	—	5 9 1
Telegraph Construction	12	10	10	23	—	5 4 2

*Dividends paid free of Income Tax.

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Our Foreign Electrical Trade.

Electrical Exports and Imports during October.

IT was to be expected that during October our electrical exports would recover from the very low level touched in the preceding month. The October Board of Trade returns show that the recovery was a substantial one, the total being the highest since September, 1926; they also show, however, that electrical imports continued their rapid upward movement and for the first time passed the million-pound mark.

Considering the exports first, it will be observed that the increase of £595,040, as compared with the September total, was spread over all the items with the single exception of carbons, which registered a decline of £1,456. Unenumerated electrical goods and apparatus contributed most to the increase (£128,079), while insulated wires and cables, the largest item in the list, showed a rise of £103,886. The machinery section as a whole advanced by £118,489, but failed to reach the 1928 level for the completed portion of the year. Although the exports of submarine cable were not abnormal, the telegraph and telephone section recorded an increase of £196,408. As compared with October, 1928 (a truer comparison) the increase in the total was not so great but was still very satisfactory. Unenumerated goods and apparatus experienced the greatest rise (£115,269), while insulated wires and cables stand out with an advance of £109,919. The telegraph and telephone section as a whole rose by £167,194. On the other hand, the total value of machinery exports fell by £10,697 on account of a decrease of £22,416 in traction motors. Batteries and accumulators also showed a substantial decrease (£19,546).

As we have already mentioned, imports again registered a considerable increase, the total being £224,492 above that of the preceding month. As in the case of the exports only one item showed a decrease—non-submarine telegraph and telephone wires and cables fell by £3,564. The greatest rise was that of £55,587 in the machinery section. Four other items were mainly responsible for the remainder of the increase, *viz.*, glow lamps (£38,440), unenumerated goods and apparatus (£35,882), batteries and accumulators (£35,756), and telegraph and telephone instruments and apparatus (£34,560). It is perhaps worthy of notice that the imports of the last class and of glow lamps were about equal to the exports of these classes. In three or four items imports exceeded exports, notably in the case of batteries and accumulators. As compared with October, 1928, the imports were nearly 55 per cent. higher, the actual rise being £356,625. About half of this increase was attributable to telegraph and telephone instruments and apparatus. Large advances were also made by unenumerated goods, glow lamps and unenumerated machinery. The exports of previously-imported goods and machinery recorded a further rise.

The subjoined table shows how our October exports of electrical machinery were distributed, and the figures are compared with those for the corresponding month of last year :—

Destination.	Oct., 1928. £	Oct., 1929. £	Inc. or dec. £
European countries ...	99,887	149,180	+49,293
Japan	5,172	19,062	+13,890
South America	56,919	36,962	−19,957
South Africa	23,514	47,346	+23,832
British India	183,350	112,258	−71,092
Australia	54,111	67,420	+13,309
New Zealand	29,614	18,378	−11,236
Canada	18,460	31,313	+12,853
Other countries	90,707	69,118	−21,589
Totals ...	£561,734	£551,037	−£10,697

As is generally the case nowadays, the exports were almost equally divided between Empire and foreign markets. It is noteworthy that while an Empire market —India—was responsible for the largest decrease, the Continental market accounted for the greatest rise. The 60 per cent. increase in the case of Canada may be considered satisfactory; in the first ten months of the year the Dominion's share was valued at £242,291, against £174,288 in the corresponding period of 1928.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Oct., 1929.	Inc. or dec. as compared with Sept., 1929.	Inc. or dec. as compared with Oct., 1928.	Electrical imports for Oct., 1929.	Inc. or dec. as compared with Sept, 1929.	Inc. or dec. as compared with Oct., 1928.	Electrical re-exports for Oct., 1929.	Inc. or dec. as compared with Sept., 1929.	Inc. or dec. as compared with Oct, 1928.
Electrical goods and apparatus (unenumerated)	£313,331	+£128,079	+£115,269	£212,323	+ £35,882	+ £70,645	£11,846	+ £685	+ £3,439
Insulated wires and cables ...	344,971	+ 103,886	+ 109,919	88,598	+ 6,468	− 3,995	1,232	+ 105	+ 253
Glow lamps	74,832	+ 35,452	+ 16,757	73,125	+ 38,440	+ 47,344	842	− 121	+ 148
Arc lamps and parts ...	3 541	+ 2 226	+ 2,611	7,896	+ 6,323	+ 2,750	24	− 65	+ 19
Batteries and accumulators ...	87,732	+ 1,361	− 19.546	132,026	+ 35.756	+ 17,169	1,086	+ 433	+ 421
Meters and instruments ...	33,127	+ 7,606	− 3,144	49,901	+ 9,667	+ 22,206	460	− 234	− 672
Carbons	486	− 1,456	− 66	12,953	+ 5,269	+ 3,108	101	− 27	− 15
Switchboards (not telegraph or telephone)	5,978	+ 2,989	+ 2,161	243	+ 104	+ 98	12	+ 12	+ 12
Electrical Machinery—									
Electrical machinery (unenumerated)	330,197	+ 84,766	+ 1.970	193,454	+ 55,587	+ 40,130	11,271	+ 2,118	+ 2,684
Railway and tramway motors	22,260	+ 5,219	− 22,416	—	—	—	—	—	—
Other motors and generators...	198,580	+ 28,504	+ 9,749	—	—	—	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	143,072	+ 7 ,571	+ 85,917	448	− 3,564	− 3,731	—	—	—
Submarine telegraph and telephone cable	98,823	+ 53,211	+ 62,998	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	238,650	+ 71,623	+ 18,279	236,956	+ 34,560	+ 160,901	5,347	+ 2,528	+ 4,535
Totals	£1,925,580	+£595,040	+£380,458	£1,007,423	+£224,492	+£356,625	£32,221	+ £5,434	+£10,824
	Exports			Imports			Re-Exports		
Inc. for ten months	+£747,190			+£1,433,605			+ £23,676		

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Frequency Control.

Some Notes on the London Power Company's Installation.*

THE gradual passing of the isolated generating station supplying its own network in favour of linking-up large groups of power houses all feeding into a common system, has rendered obsolete the present haphazard methods of frequency control in favour of a scheme which will ensure a rigorously correct frequency throughout the area. When a number of power houses are connected to a common transmission system, it becomes necessary to divide the total load, either according to some pre-arranged programme, or by instructions issued from time to time by a control engineer, or, as he is sometimes called, a "load dispatcher." If a power station is to increase its share of the load, it can only do so by giving more steam to the turbo-alternators, thereby tending to increase the frequency. As a result, the other interconnected stations lose some of their load, and in the absence of some pre-arranged system they probably increase their steam in order to regain their load. Thus, the frequency is still further increased, and this goes on until the engineer at one of the stations proceeds to lower the frequency. The other stations then find that they are carrying more than their share of the load, and take similar action; thus the process repeats itself, with inevitable hunting and "load pinching," as it has not inaptly been called.

To overcome this trouble, it is now generally agreed that only one station on such a system must control the frequency, whilst each of the other stations supplies its predetermined load. "Controlling the frequency" in this sense necessarily carries with it the supplying of whatever surplus power may be required to make good sudden variations in the load, and the criterion of whether more or less power is required is no longer the voltmeter, but the frequency meter. For this purpose, the ordinary indicating frequency meter is altogether inadequate, partly on the score of limited accuracy and slight differences in calibration between individual instruments, but still more owing to the fact that small temporary variations in frequency are inevitable, and usually without significance. It is, moreover, almost impossible for the operator to counteract them, whereas it is an easy matter for him to maintain an accurate *mean* or average frequency at all times, and that is actually what is required.

In view of the importance of the subject at the present time, a brief description of the method of frequency control adopted by the London Power Company will be of interest. The problem was that any one of the four existing power stations at Willesden, Grove Road, Deptford West, and Bow, as well as the new station at Battersea, when completed, should be in a position, at any moment, to take over the frequency control of the entire system. Further, that each station should have a continuous indication of the mean frequency of the system, or, if that station were temporarily disconnected therefrom, of its own mean frequency, so that it could be at any moment reconnected with the least possible delay. The system adopted for this purpose employs the Everett-Edgcumbe master frequency meter, which consists essentially of a dial provided with two pointers carried by concentric spindles, the one driven by a master clock and the other by a truly synchronous motor (the Warren motor). These pointers are so geared that when the frequency is correct, the speed of rotation of the motor-driven pointer corresponds exactly with that of the clock-driven pointer, and any gain or loss by one over the other indicates that the mean frequency is either too high or too low, as the case may be.

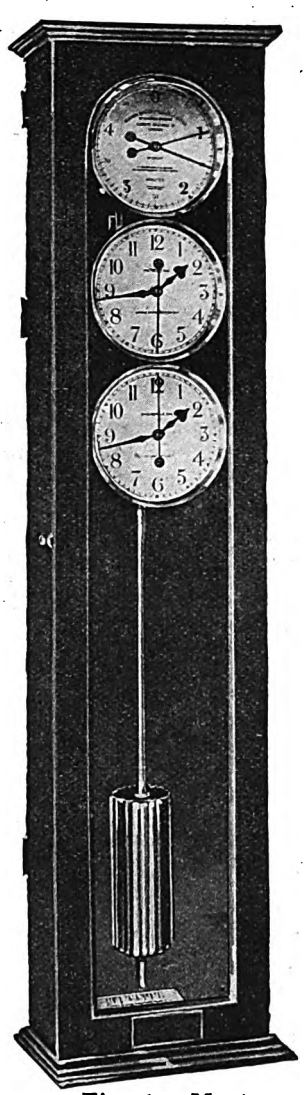

Fig. 1.—Master Frequency Meter at Ergon House.

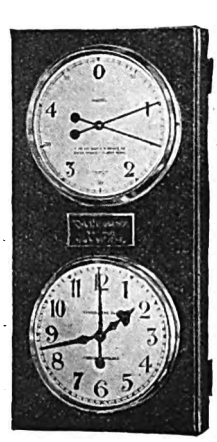

Fig. 2.—Sub-frequency Meter.

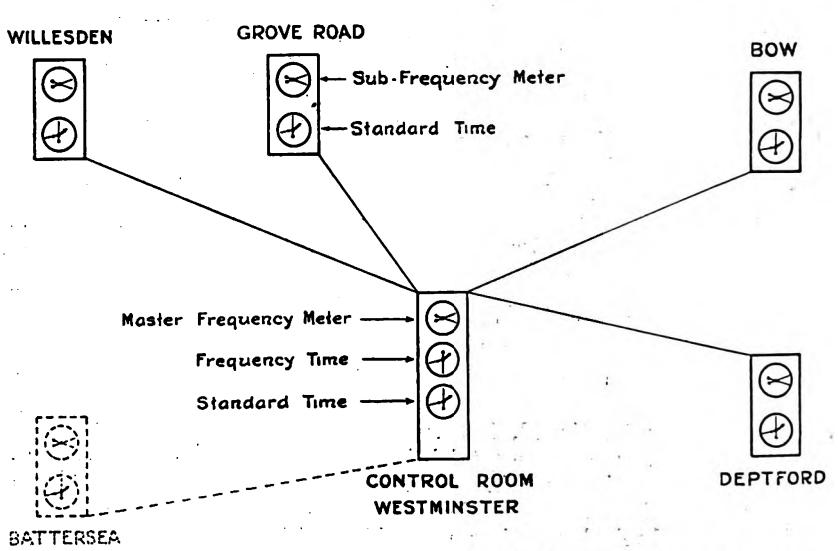

Fig. 3.—Lay-out of London Power Co.'s Frequency-Control System.

The master frequency meter installed in the central control room of the London Power Co., Ltd., at Ergon House, Horseferry Road, Westminster, is shown in fig. 1. In addition to the dial containing two pointers (the top dial), two ordinary clock dials having hour, minute and centre seconds hands, are provided. One of these dials (the middle one) indicates what may be termed "frequency time," and is operated by a Warren synchronous motor; the other indicates standard or reference time, and is driven from the master clock. Any difference in the rate of these two dials can only be due to a deviation of the frequency from its true value, and it provides an additional check on the readings of the two pointers on the top dial, and so serves as a stand-by, should it ever be required. In the usual Warren master frequency meter, the master clock consists of an electrically-wound, weight-driven, precision movement, with a seconds pendulum of invar steel, and can be relied upon to keep accurate time within a second or so per day. In the case of the London Power Co., however, it was desired to give each generating station an exact replica of the standard time dial in the control room at Ergon House, and this has been accomplished by installing there a Synchronome-driven master clock instead of the standard weight-driven master clock. The one-second current impulses from this

* See also ELECTRICAL REVIEW, June 7th, 1929, p. 1035.

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clock are transmitted by means of pilot wires to the generating stations, in each of which a sub-frequency meter, as shown in fig. 2, is installed. The upper dial of this instrument is similar to the top dial of the master meter (fig. 1), that is to say, it is provided with two concentric pointers, one driven by a Warren synchronous motor from the station busbars, and the other by the current impulses from the master clock. The lower dial in fig. 2 is provided with hour, minute and centre seconds hands, and is likewise driven by the current impulses, and indicates "standard time." Fig. 3 shows, diagrammatically, the layout of the system.

It is ensured that so long as a station is connected to the system, the readings on the two dials will agree exactly with the readings on the corresponding dials of the master frequency meter in the control room at Ergon House. Should any one of the generating stations be disconnected from the main system for any reason, such as owing to fault conditions, and be therefore compelled to control its own frequency, it can do so by means of the upper dial, since the standard time hand thereon is synchronised from the control room. By this means, the station is at any moment in a position to connect once more to the system without the usual delay entailed in equalising the frequency by means of the synchroscope.

The concentrically mounted pointers on the upper dials of figs. 1 and 2 revolve once in five minutes, so that a difference of a few seconds in the position of the two hands is readily detected. On the assumption that the master clock is maintained correct within one second in 24 hours, the error in the average frequency will be less than 1/1,000th of 1 per cent. A difference of 5 seconds in the position of the two pointers on the upper dial is easily discernible, and this corresponds to a difference of 0.005 per cent. in the mean frequency. This figure may be contrasted with the allowable inaccuracy of 1 per cent. for an indicating frequency meter under B.S.S. 89/1929. Thus, instead of frequency measurement being one of the least accurate, it now ranks as the most accurate of all industrial electrical measurements. The London Power Co., in fact, finds that it is able, not only to *measure* the mean frequency with an accuracy of a few parts in a thousand, but actually in practice to ensure that *the frequency of its entire system does not differ from the true value* by more than an amount of this order.

It may be well to point out that whilst a properly controlled frequency is essential from the point of view of systematic load sharing between interconnected generating stations, it possesses innumerable advantages for the consumer. An absolutely synchronised time system is provided, and every consumer has at his command, from the nearest wall plug, a simple and almost ideal means for operating timepieces. These electrical clocks, termed "Synclocks," are operated by miniature synchronous motors. No master clock, batteries or other accessories are necessary, nor, of course, is any extra wiring; moreover, there is no winding, regulating or setting to be done. The fact that the London Power Co., and also many other supply undertakings, are accurataly controlling their frequency enables these "Synclocks" to be used by any consumer connected to their a.c. mains, and forms an ideal system of accurate time-keeping.

Two Municipal Supply Developments.

Extensions to the existing power station at Stoke-on-Trent and a bulk supply sub-station at Bermondsey were recently inaugurated.

Stoke-on-Trent Extensions.

AN electricity supply in the Potteries was first introduced in 1894, and the original station in Hanley had a capacity of 200 kW. With the formation in 1910 of the Pottery towns into the County Borough of Stoke-on-Trent, however, the need for more central works was recognised, and in 1913 the present power station was inaugurated with two 1,500-kW sets. Since the war additional plant has been installed at frequent periods, culminating with the starting up on October 31st last of a 12,500-kW set, which raised the capacity of the station to 37,500 kW. The latest extension is interesting in that it is the last to be made before the station passes from the control of the City Council to the North-West Midland Joint Electricity Authority in April next.

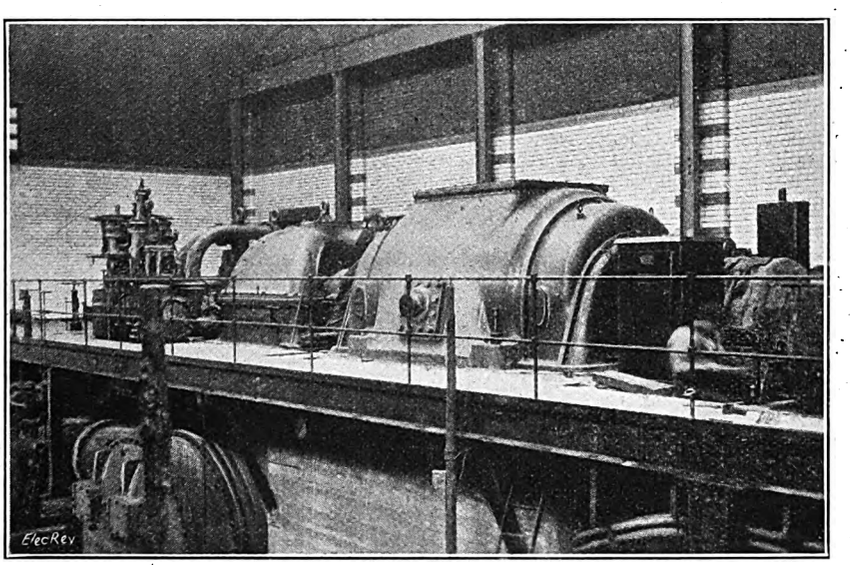

Fig. 1.—The New 12,500-kW Set at Stoke.

The new turbo-alternator, fig. 1, consists of a single-cyinder turbine of the impulse type, driving a 12,500-kW, 3-phase, 50-cycle alternator supplied by the Metropolitan-Vickers Electrical Co., Ltd. The working steam pressure at the turbine stop-valve is 250 lb. per sq. in., while the total steam temperature is 650 deg. F.; the machine speed is 3,000 r.p.m. A M.V. central-flow surface condenser installed with the turbine is designed to maintain a 28.45-in. vacuum at full load when supplied with 792,000 gallons of water per hour at 70 deg. F. It has a cooling surface of 16,250 sq. ft. Interesting points regarding the construction of the alternator are that the stator core and the stator winding at the neutral point have embedded thermo-couples, so that the actual temperature in the interior of the generator can be ascertained while it is under load. The quantity of cooling air required by the alternator is 30,000 cu. ft. per min., and this is dealt with by the maker's closed-circuit system of air-cooling, which includes an automatic alarm if the air temperature rises above a safe limit, and also dampers which can be opened to give cool air to the system. The exciter is of the overhung type.

The boiler house extensions have been carried out by Messrs. John Thompson Water-Tube Boilers, Ltd., and comprise two boiler units, each consisting of the company's "Delta" type boiler, with integral superheater, economiser, air heater, induced- and forced-draught fans, &c. Each boiler has a normal evaporation of 60,000 lb. of steam per hour at a pressure of 275 lb. per sq. in., the steam being superheated to 660 deg. F.

A new cooling tower has been supplied by the Davenport Engineering Co., Ltd. This is of the natural-draught two-chimney type, and is designed to deal with 450,000 gallons of water per hour. Extensions have been made to the e.h.p. switchgear by the addition of six metal-clad circuit-breaker units, with remote control apparatus, supplied by the Metropolitan-Vickers Electrical Co., Ltd. Each switch has a rupturing capacity of 350,000 kVA. The service transformer for the auxiliary motors of the new equipment was also supplied by this company, and is an 800-kVA, 3-phase unit. It takes power at 6,600 V and gives a supply at 415 V.

Messrs. A. Reyrolle & Co., Ltd., supplied the switchgear for the l.p. supply to the station auxiliaries. The existing board has been extended by the addition of a bus-bar sectionalising panel and one transformer panel, both type "B2," with a rating of 1,500 A, and a breaking capacity of 100,000 kVA. Four 400-A type "E" feeder panels with a breaking capacity of 25,000 kVA have also been installed to control the supply to the power distribution boards in various parts of the station.

The heavy cables in the power house have been supplied, jointed, and erected by Callender's Cable & Construction Co., Ltd., the wiring for lighting and small motors being carried out by Messrs. Barnett & Soans. An additional station 60-cell battery of 1,200 ampere-hour capacity on a ten-hour rating

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has been supplied and erected by the Chloride Electrical Storage Co., Ltd.

The whole of the extensions were designed by Mr. C. H. Yeaman, the city electrical engineer.

The Bermondsey Sub-station.

A provisional Order, giving powers to supply electricity in a portion of the borough of Bermondsey, was granted to the Bermondsey Vestry in June, 1899, and later an additional provisional Order was granted to the Bermondsey Borough Council to supply the Rotherhithe area. Under these Orders

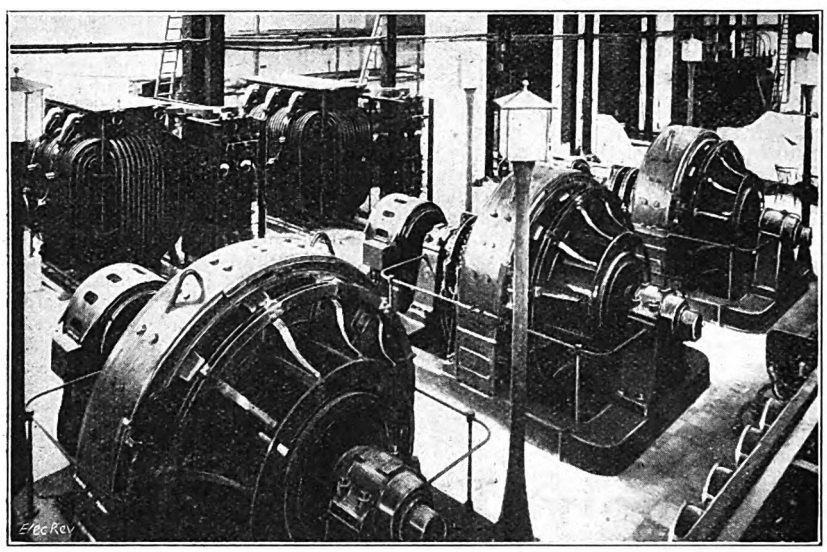

Fig. 2.—Convertor and Transformer Equipment at Bermondsey.

the undertaking commenced the generation and distribution and supply of electrical energy in January, 1902. Since the inauguration of the supply, a steady progress has been made necessitating extensions to the machinery and mains from time to time.

Early in the year 1928 the borough electrical engineer, Mr. J. G. Doran, A.M.I.E.E., was instructed to formulate a scheme in accordance with the Electricity (Supply) Acts, which was duly submitted and sanctioned. Under this scheme the new station is connected with the large generating stations supplying in bulk under the control of the Central Electricity Board. H.p. current at a voltage of 22,000 is received and transformed and converted to 480 and 240 volts d.c. for distribution throughout the borough.

The new bulk-supply sub-station, which was officially inaugurated on October 26th by the Mayor of Bermondsey, Councillor G. A. Howard, J.P., is to some extent remarkable on account of the economy of space embodied and the facility given for the most efficient working of the concern generally. On the main floor of the station are the machines and switchgear, and a feature is the extensive use of glazed bricks in the various pits and foundations. A 20-ton travelling crane spans the room. The upper floor is laid out as offices and stores.

The electrical equipment consists broadly of the e.h.p. switchgear, transformers and rotary-convertors, a main three-wire d.c. switchboard, and a further d.c. switchboard for the supply to the London County Council tramways. The e.h.p. switchgear was supplied by Messrs. A. Reyrolle & Co., Ltd., and is of their metal-clad horizontal draw-out design. It is built up into two switchboards, one board controlling the main incoming feeders and the cables therefrom to the second part, which controls the supply to the station machines. Each board is equipped with duplicate bus-bars throughout, and is fitted with solenoids for electrical operation. A slate control board is conveniently situated, and serves both e.h.p. boards.

The rotary-convertor equipment, fig. 2, consists of three 2,000-kW rotary convertors coupled to three 2,200-kVA oil-immersed self-cooled core-type transformers, and one 1,000-kW rotary convertor coupled to a similar transformer, each convertor being supplied with a self-synchronising starting panel. The convertors and transformers were supplied by the General Electric Co., Ltd., and are of that company's standard make. The larger convertors run at 500 r.p.m. and supply direct current to the main switchboard at 500 volts, while the 1,000-kW machine runs at 750 r.p.m. and is provided with tappings on its transformer and a change-over switch, so that it can either be used to supply 500 volts to the main switchboard or 600 volts to the tramway switchboard. Each machine is started up by means of a squirrel-cage motor mounted on an extension of the bed-plate. The d.c. voltage control is effected by means of reactances embodied in the transformers; this enables the voltage to be adjusted by simply moving the shunt field regulators, which are mounted on the control panels.

There is also one 1,500-kW rotary convertor, supplied from a 25-period, 6,600-volt system, which has been removed from a sub-station which is being superseded, and a further similar machine will be erected eventually.

The main l.p. 3-wire d.c. switchboard, fig. 3, which was supplied by Crompton Parkinson, Ltd., is believed to be one of the largest in the country; it consists of 27 panels, totalling approximately 80 ft. long by 8 ft. 6 in. high. The board consists of enamelled slate panels of high insulating quality, bushed with mica, and is designed in accordance with the latest Home Office and fire insurance regulations.

The whole of the cable work in this connection has been done by the Bermondsey borough council's staff, and the feature of the work is the regularity of the spacing of the cables and the exceedingly small length of cable actually in the building itself. Every cable is readily accessible, and the crossing of any one cable over others has been virtually eliminated. Outstanding features of this board are the simplicity of its design, the accessibility at the back, and the arrangement provided for easy manual control.

There is also another switchboard, designed and erected by the London County Council Tramways Department staff, which deals with the supply to the tramways in Bermondsey and a portion of Deptford. To a further board pilot cables from various parts of the network are brought, so that the pressures can be remotely recorded.

The station is designed for the total capacity of 12,000 kW. The whole of the plans and specifications for the electrical equipment and the supervision of the installation throughout, including the transfer of plant from the old to the new station, have been carried out by Mr. Doran and his staff.

Ships' Auxiliary Turbo-electric Drive.

A trial run was carried out on November 6th with the P. & O. mail liner *Mooltan*, to which an auxiliary turbo-electric propeller drive has been fitted, the motors being arranged in the propeller shaft and taking current from turbo-generators, which get their steam from the low-pressure cylinders of the two main reciprocating engines.

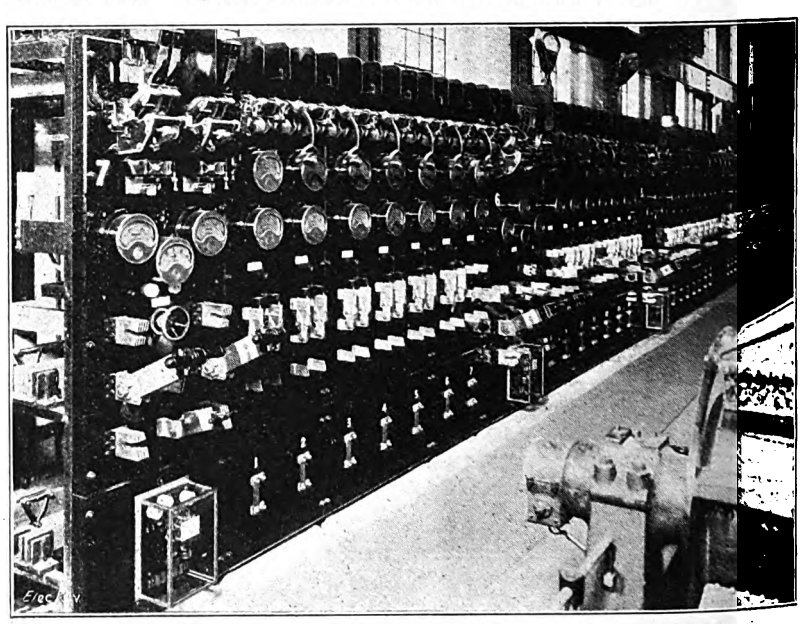

Fig. 3.—The Bermondsey D.C. 3-wire Switchboard.

Interesting results are expected from this important innovation in marine propulsion technique, which has been compared in its functions to supercharging Diesel engines. Extra speed and power can be obtained for a practically negligible increase in the fuel bill, and the electrical installation is very economical in space. This type of propulsion (see also Elec. Rev. November 1st, 1929, p. 766) is claimed to be doing more to restore steam to its former position in certain ship types than almost any other recent development.

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The Inland Telegraphs.

Some causes and effects: an attempt to outline the author's idea of the function of the telegraph service in the future.

By T. E. HERBERT, M.I.E.E.

(*Extracts from chairman's address before the* NORTH-WESTERN CENTRE *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE inland telegraphs were bought by the State from the Companies in 1870, and it is now recognised that the £11 millions purchase price was too high. It was, indeed, only 12 per cent. less than the £12½ millions paid to the N.T. Co. in 1912 for the vastly larger plant of its telephone system. Those facts do not, however, explain the loss on the inland telegraphs to-day. At the transfer special rates for Press messages were inaugurated, and the improved facilities for news distribution were definitely in the interests of the general public. Indeed, no modern newspaper could exist without the aid of present-day methods of electrical communication; hence, the development of the newspaper was in no small measure rendered possible by the cheap Press message, which advantage was shared by the community at large. It would, therefore, be arguable that the special concession has been justified, but to-day there is no justification for any such subsidy of the public Press. In fact, all the great newspapers have private wires of their own, in order to save the delay inseparable from the transmission of messages between post offices and newspaper offices; in other words, the greater celerity amply justifies the very heavy charges which this policy entails.

It should not be overlooked that the inland telegraph system is the medium by which foreign messages are distributed to recipients throughout the kingdom, and thus perform a most valuable function for the community. At the transfer the charge was reduced to 1s. per message, and the system was extended, so that offices from which telegrams could be sent had increased to 14,222 by 1914. The telegraphs were not developed on purely commercial lines, but as a national service. The aim was to bring every centre of population within the range of communication, regardless of whether it would pay to do so. Commercial methods would, of course, have resulted in concentration on profitable business alone, and would have left villages in a continued state of isolation. A record of the total traffic is given below:—

Year.	Total Messages. (Millions.)	Inland Messages. (Millions.)
1870*	8½	—
1884†	33	—
1915‡	91	72
1920§	94	74
1925	67	49
1929	59	44

* Transfer to State.
† 6d. telegrams, 1885.
‡ 9d. ,, November, 1915.
§ 1s. ,, September, 1920.

The revenue from the service has never been sufficient to pay interest on the capital. Of the loss, Press messages represent £225,000 per annum. By 1881 the balance of receipts over expenditure had nearly reached the interest due on the stock, which position was, however, profoundly modified by the introduction of the 6d. telegram in 1885, that reform having been carried out deliberately by Parliament, in spite of the known loss that would occur. In 1925 the loss was £1,645,000 (which figure included £300,000 paid for war services) and in 1928 it was £1,381,000.

In 1913 some 64 per cent. of the total communications (telegrams, plus telephone calls) were sent by telegraph, whereas in 1926 the figure was only 36 per cent. of the total. In America 150 million telegraph messages were sent over the Western Union system alone during that year, and that figure was 2½ times the number handled ten years ago, which shows the vast difference between England and the States in the use of the telegraph facilities. The explanation is, however, quite obvious: we are a small country and our distances are short. If the telegraph is to be quicker than other means of conveying messages, the time available from the initiation to receipt of a message must be much less here than in America, where the distances are vastly greater. The greater time available for telegraphy brings with it differential charges based on distances and also on celerity. The advantages of evening up the load curve need no voicing.

It is reasonable to suppose that the number of messages that is sent direct by the sender to the recipient will tend to increase. A telephone message occupies an individual pair of wires for the whole time that the conversation takes place, whereas several messages can be sent simultaneously on a single telegraph wire by the Baudot multiplex and by voice-frequency telegraph systems; but the present tendency is towards the use of sub-audio telegraphy worked on telephone trunk circuits, or, alternatively, superposed on such circuits with thermionic valve reception of the signals. For example, a four-wire core affords three telephone circuits (two physical and a phantom) and over the centre of the phantom a telegraph circuit can be worked without affecting the telephony. At the telephone repeater stations all that is necessary is to connect across the central points of the telegraph superposing transformers, and consequently the plant cost is only a fraction of the similar cost of telephone trunk lines. There is, however, the fundamental difference that a telegram has to be signalled by hand, whereas the work of a telephone operator is confined to making and severing the required connections. Hence it is only over very long distances that telegraphy becomes the cheaper method of conveying messages. In the case of an Atlantic Ocean submarine cable the position is reversed, the operating cost in human labour being small in comparison with the plant cost. More human energy is employed in the transmission of a telegram than in setting up a telephone call, and on receipt a telegram has generally to be delivered by hand. In the case of country villages the telegraphs are still serving the purpose for which they were originally designed. Incidentally, many such telegrams are transmitted over telephone circuits to the nearest large telegraph centre.

To-day it is quite clear that the Wheatstone automatic system must disappear altogether, and it seems equally probable that multiplex systems will also have a very restricted field of utility in this country. In fact, Morse signalling, whether manual or automatic, is doomed, chiefly on account of its inefficiency in the use of human effort. It may be well to remark that the losses on telegraph service would not disappear if all the plant costs were eliminated entirely, and so the future line of development in so small a country as ours will not consist in plant-saving devices, such as multiplex, voice frequency, or automatic systems, but in the adoption of methods which obtain the results with the minimum expenditure of human effort. The deduction from this would appear to be that heavy expenditure on plant is amply justified wherever labour saving can be effected. At the moment the replacement of all forms of apparatus by "start-stop" telegraphs is beginning. Telegraphy is very largely mechanical in character, whereas in telephony the mechanisms used are of the simplest character. The teleprinter works at about 60 words per minute, but even that speed is inadequate to wipe out the loss on telegraphs. The manual re-transmission of messages is necessarily a costly process, and evidently must be avoided to the utmost extent. In the early days experiments were made in telegraph switching, but were abandoned. A comparatively elaborate system existed in Belgium some 30 years ago, and the metropolitan intercommunication system devised by Col. Sir Thos. Purves in 1900 (by which sub-offices in London were interconnected at a switchboard), owing to the decline in messages across London, due probably to the more intensive development of telephones, ultimately failed to justify its continuance. It is interesting to note that the first exchange was not for telephony, but for telegraphy, and was working prior to 1870 at Newcastle with Wheatstone A.B.C. apparatus; in 1884 it was converted to telephony.

What is likely to be the line of future development? Some twenty or thirty years hence the business community will have discovered that speeding up its methods will enable more business to be done with much less effort. There will, moreover, be such legislation in vogue as will prevent the recurrence of frequent financial upheavals, and will thus enable people to concentrate on useful work. Much more attention will then be available for concentration on doing things in the simplest, quickest, and most direct way, and the leisure thus obtained will certainly in the main be devoted to worthy objects.

Every business office will be equipped with a teleprinter, and by means of a dial form of automatic switching communication will be direct with the recipient. In the case of very small firms, possibly the telephone connection may be used for the dual purpose, or perhaps several small firms may share a single telegraph wire. The messages will be received on a form of receiving perforator in the main telegraph office

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of the town to which the recipient is connected, and in that way the message will be stored and sent in automatically to the recipient as soon as his circuit is free. Several machines may be "lined up" on a rotary line-switch with messages for a single subscriber, which will discharge the messages in sequence, and enable them to be dealt with in a strictly routine manner. The telephone will, on the other hand, be used when discussion is essential.

A service of that type will need a large number of circuits, but they are already available, since it has been demonstrated that telegraphy can be worked at sub-audio frequency on telephone trunks without appreciable deterioration of the latter. When that source fails, voice-frequency systems, or even multiplex systems, controlled by precision vibrators as regards the division of line time will certainly meet the requirements.

There remains the problem of the delivery of purely private messages; when the recipient is not on the telephone (and the percentage of such messages to the total messages would tend to fall) there seems no alternative to delivery by messenger. If, however, the system as a whole can be made remunerative, that does not seem a very serious matter. The advantages of the plan outlined consists in transferring the human labour to the subscriber, but that does not represent any serious addition to his necessities, since the message can be telegraphed with just the same labour with which it would have in any case to be typed.

That the development postulated is by no means visionary is exemplified by the following extract from the *Wall Street Journal*, New York, U.S.A., July 27th, 1929:—

"The Bell system has developed a telephone typewriter which provides equipment and circuits and gives a service which permits subscribers to handle their own messages, telephone or telegraph, in their own way. Telephone typewriter instruments have to a large degree the flexibility of telephone instruments, and can be interconnected through suitable switchboards in the same manner. It is, therefore, quite feasible to provide a large number of subscribers in their business offices with these instruments, and to furnish wire interconnections between the subscribers as they may indicate their desires. The service need not be confined to a single city, but any subscriber in New York may be connected to any subscriber similarly equipped in some other city, the time required to complete the connection being of the same order as that required to complete a telephone connection between the same two points."

Salesmanship and adequate publicity are clearly essential to the early realisation of such a scheme. The engineering details would present no insuperable difficulties.

Radio-telephony Interference.

Extracts from a G.P.O. report on an investigation of interference by tramway and electric trolley-omnibus services with broadcast radio-telephony reception.

RADIO report No. 135, recently issued from the engineer-in-chief's office of the General Post Office, London, deals with interference with the reception of broadcast radio-telephony caused by tramways at Blackpool and tramways and electric trolley omnibuses at Birmingham.

Complaints of such interference had been received in the past from many districts, and no general remedy had been found for the trouble, although, in certain isolated cases, slight improvement had been effected by the alteration of aerial position and/or the use of a counterpoise "earth." It was known that the Fischer-plate type of overhead collection was in use on the Continent, and that its introduction into this country was imminent. It consists of a grooved-sliding collector about 4 ft. long by 4 in. broad, packed with grease and surmounted on a bow, the length being transverse to the collector wire. The spring tension on the bow is less than that on the normal trolley arm, and, in conjunction with the lubrication effected by the grease, greatly reduces overhead line maintenance cost, which reduction is the only reason for the adoption of the Fischer plate by local authorities, but it was thought that its use might at the same time reduce tramway interference.

Arrangements were accordingly made for tests at Blackpool in December, 1928, but, in the meantime, an English invention (the Dudgeon shoe) was made the subject of tests at Birmingham. This device, which consisted essentially of a trailing shoe behind the ordinary trolley wheel, is intended to bridge the gaps in the collector wire and to preserve contact when the trolley wheel passes over a suspension ear. Normally, the trolley wheel jumps at a suspension ear, an arc is produced, and the ear and collection wire become badly burnt; arcs also occur at all gaps in the overhead wire, and it was thought that the trailing shoe would minimise the burning. Under normal conditions, the arcing at those points may be definitely heard in a wireless receiver as sudden clicks as each ear or gap is traversed by the trolley. The Birmingham tests showed that the collector clicks were reduced when Dudgeon-shoe cars were used, but, at the same time, it was apparent that interference from other tramway sources was of far greater intensity and duration than the collector noises.

The overhead suspension system normally used for tramways is not best suited to plate collectors, since riding at the ears occurs when a plate traverses them. A special type of suspension ear, necessitating the use of a grooved (instead of a round-sectioned) conductor, obviates this defect, and its adoption at Birmingham is under discussion, whilst the standardisation of conductor, ears, frogs, and cross-overs to meet the requirements of plate collectors is in hand.

In December, 1928, at Blackpool, where the improved types of collector wire and suspension ears were in use, better conditions than at Birmingham obtained, and great improvement resulted from the use of a Fischer plate; collector and section clicks as heard on a portable receiver (2 h.f.-det.-2 l.f.) situated 10 yards from the tramway route being considerably reduced in volume. It was noted, as at Birmingham, that the greater interference was from other tramcar sources. In collaboration with the British Broadcasting Corporation, further tests were carried out at Blackpool during April, 1929, as were tests by the Post Office Radio Department on trolley-'buses and tramcars at Birmingham in July, 1929.

Two 500-volt d.c. traction motors were provided on each vehicle with series or parallel switching arranged at the controller; the main differences between tramway and trolley-'bus systems were therefore:—(i) absence of air-brake compressor motors in the railless (trolley) 'buses; (ii) overhead earth return in the railless system, giving (*a*) approximately double the number of suspension ears and section points; (*b*) an earth potential varying by about 50 volts on account of the long sections of return conductors, in conjunction with a chassis insulated by the tires; (*c*) supply and return feeders running parallel and fairly closely together, thus rendering the use of Fischer plates impracticable.

First tests showed that interference was present when no cars were in sight and that a background of interference (heard during the working hours of the tramway service) gradually decreased as the tramcars returned to the depot at night, with a corresponding building-up of the noise in the background with the commencement of the service in the morning. The background noise built-up considerably as any car passed the receiver at the observation point, and it was evident that a collective effect of all the cars then in service was being heard. Conclusive tests under those circumstances were impossible, and it was, therefore, arranged that trial runs of the test car and standard car should be conducted when no other cars were in service, as follows:—

(i) The insertion of a stopper circuit (tuned approximately to 19,000 metres) in the downlead from the Fischer plate to the controller, consisting of a coil of 100 μH inductance shunted by two 2 μF condensers in series, with their mid-point earthed; (ii) the transposition of the traction and compressor-motor series coils from the low potential side of the motors, *i.e.*, their arrangement as high-frequency chokes between the motors and overhead-collector wires; (iii) the provision of 2 μF condensers in series, with the mid-point earthed, across the series coils of the traction motors in their transposed position; (iv) the provision of 10 μF condensers across the brushes of the traction motors.

In the case of the railless trolley-'bus service the tests were as follows:—(i) provision of two 2 μF condensers in series across each traction motor; (ii) earthing the mid-points of the condensers in test (i) to the return conductor by means of another 2 μF condenser; (iii) insertion of the stopper circuit in the downlead, as for the tramway tests; (iv) transposition of the field coils. The results of the tests were as follows:—

Collector Systems.—The Fischer plate successfully eliminated the greater proportion of collector noises. The Dudgeon shoe also gave an improvement, but not to the same extent. At Birmingham, Dudgeon shoes are already being replaced by modified Fischer plates.

Tramways.—(i) The stopper circuit reduced the interference to about 80 per cent. of its original volume; (ii) the transposition of the field coils reduced the interference to about 45 per cent. of its original volume in the case of the traction motors and to about 20 per cent. in the case of the compressor motors; (iii) interference caused by both cars (test and standard) was less in wet weather; (iv) the tests on the efficacy of the condensers across the armatures and field coils

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were carried out in wet weather, and no improvement was observed; however, they effected slight improvement in dry weather (bad rail contact) conditions; (v) the effect of the field-coil transposition, armature condensers, field-coil condensers, and filter circuit, taken together, gave the following improvements:—

Noise due to car.	Starting.	Passing Section Point.	Passing Observation Position (40 yd. span).	Stopp'ng (Control'r Noises).
	%	%	%	%
Noise due to standard car taken as	100	100	100	100
Noise due to treated car (average of three independent witnesses) ...	10	45	40	15

(vi) Final tests between the treated and untreated cars during afternoon service hours showed that the background noise was about 15 per cent. of the strength of the Daventry (5 XX) signal. The standard car, in passing the observation point, increased the percentaege to 100 per cent. whilst traversing 800 yards; the treated car increased the percentage to 50-60 per cent. only, whilst traversing 200 yards.

Trolley-'Buses.—(i) The provision of condensers across the armatures, with or without an additional condenser to earth, gave no apparent improvement; (ii) the filter circuit alone gave about 10 per cent. improvement as regards volume: (iii) the transposition of the field coils also gave about 10 per cent. improvement in volume; (iv) The distance over which interference was experienced was only slightly reduced as a result of the field transposition and the filter circuit; (v) in certain localities, tramcar and trolley-'bus routes run in the same street, and, to avoid complications of the overhead systems, the return trolley is pulled down and anchored and an earth skate (consisting of a series of metal rollers metallically connected to the chassis) is trailed in the tramway rail; over routes of this description the improvement figures of 10 and 10 per cent. quoted above were increased to 15 and 75 per cent. for the stopper circuit and field transposition respectively; (vi) controller clicks were prevalent.

The conclusions drawn are that collector noises are greatly reduced when plate collectors are in use, and are practically eliminated when the overhead system is adapted fully to meet the plate collector requirements. Various types of plate collectors are in use, or are to be tried, in this country; while only the Dudgeon shoe and Fischer plate have been reported upon, it is thought that any plate or shoe collector will improve freedom from overhead clicks, compared with the usual trolley collector with its one-point contact. Plate collectors necessitate a bow or pantograph mounting, which obviates changing end-for-end at termini and gives an additional improvement, since there is no searching for the overhead collector by the driver, and a consequent absence of plops in wireless receivers. Occasional section points are so bad that the plate jumps-off the conductor when a trolley bow is used, and for this reason a vertical pantograph is preferable. The greater proportion of tramway interference is not from the collector system.

In the case of interference from tramways and railless 'buses using a skate, the transposition of the field coils of traction and compressor motors causes an immediate and considerable improvement. The improvement is present, but not so marked, on those trolley-'bus systems employing an overhead return. In view of the fact that tramway interference generally consists of a background of noise, due to all running cars, which builds-up on local receivers as individual cars pass them, the transposition of the traction and compressor-motors fields of all car operating in all towns is considered to be a practical means of reducing interference with broadcast radio-telephony. It is possible that such a wholesale transposition, in conjunction with the use of a plate, or similar method of collection, will render reception satisfactory so far as interference from tramway systems is concerned. The transposition of coils on the traction motors of trolley-'buses would also reduce interference, although on those systems employing an overhead return the improvement is not expected to be so marked.

Protecting Aluminium Against Corrosion.

Brief Descriptive Details of the Various Processes Applicable to the Metal and its Alloys.

THE first meeting of the 1929-30 session of the Electroplaters' and Depositors' Technical Society was devoted to the discussion of a paper read by Mr. H. Sutton, M.Sc., of H.M. Royal Aircraft Establishment, entitled "Some Recent Developments in Protective Coatings for Aluminium and its Alloys," which dealt in an interesting way with the latest developments and more particularly with those methods of which the author had personal experience.

The Paper.

The anodic oxidation process due to Bengough and his collaborators consisted in making the article to be treated the anode in a bath of 3 per cent. aqueous chromic-acid solution, the voltage being raised gradually from zero to 40 volts in 15 minutes, maintained there for 35 minutes, raised to 50 volts in 5 minutes, and maintained there for a further 5 minutes; by which means a protective coating of oxide was produced on all parts of the surface accessible to the electrolyte.

Graphite plates had been used extensively as cathodes and, in general, had given satisfactory service. It had been found possible to use clean steel plates as cathodes, or, when convenient, the tank itself, but stainless steel was preferable to ordinary steel for the purpose. Steel containing from 0.10 to 0.15 per cent. carbon and from 12 to 14 per cent. chromium had given the best results as a material for cathodes and tanks. That steel was not an easy one to weld, but, by the use of special technique, could be worked up into satisfactory tanks for anodic plant. In the operation of the anodic process there was a tendency for the chromic acid to be reduced at the cathodes and thereby rendered useless. The amount of reduction occurring was influenced greatly by the nature of the cathodes; for example, stainless steel of the type mentioned caused less reduction than any other material so far employed.

Chlorine and chlorides were very undesirable impurities and had given rise to considerable trouble, due to the fact that they caused breakdown of the anodic film and severe local attack on the aluminium or alloy during treatment in the normal manner. The chloride content of the electrolyte should not be more than the equivalent of 0.02 gram NaCl per 100 cc in order to avoid trouble from that cause.

The anodic process could be applied to aluminium, duralumin, and most aluminium alloys, but alloys containing more than 5 per cent. of copper had not proved capable of being treated. Duralumin, Y alloy, and similar alloys, could be treated equally well, whether in the final heat treated and aged condition, or after softening treatment. Provided that reasonable care was taken to avoid scratching the film, &c., pieces could be heat-treated satisfactorily after anodic treatment, but if a salt bath was used the film would be likely to be injured to some extent unless the salt, usually sodium nitrate, was of fairly high purity. There was a marked difference between the appearance of softened duralumin and of heat-treated aged material after anodic treatment, the former being rendered a dark grey, compared with the latter, which difference had occasionally proved of service as a method of distinction. Attempts to treat unsuitable alloys were very injurious to the bath, since pitting and solution of the aluminium occurred. Contact of aluminium or alloy under treatment with steels prevented the normal operation of the process; contact with brass resulted in rapid and severe attack on the brass during treatment.

The anodic oxidation process tended to open up and reveal clearly any defects, such as laps, seams, &c., in the metal occurring at the surface; also to disclose any attempts to plug up blow holes, holes drilled in wrong places, &c.

The protection against corrosion afforded by anodic films was much improved by the subsequent application of suitable paints, or enamel, or grease. Lanolin was much used for the purpose and was probably applied most conveniently in the form of a solution of white spirit 45 per cent., solvent naptha 45 per cent., and lanolin 10 per cent. by volume.

The Jirotka process consisted in obtaining a film on the surface by immersion in a bath of an aqueous solution of suitable salts, notably chromates and the salts of the heavy metals, kept at a moderate temperature. The treatment afforded considerable protection against corrosion. The variation in colour of the films obtainable suggested considerable scope for the process in decorative work.

Of the Stafford O'Brien process precise details were not available, but it was stated to consist of anodic treatment at low voltage in sulphuric acid containing a chloride, and it was claimed to be effective on aluminium alloys, including the high-copper alloys.

"Alclad," a form of duralumin having a coating of aluminimum of high purity, was being produced, the object of the coating being to protect the underlying duralumin from corrosion. It was understood to be applied by means of a special casting process, and not to the sheet as such. The makers claimed that the attack by a corroding agent at cut edges was borne by the metal of the coating, and not by the duralumin.

"Calorising" consisted in packing the pieces to be treated in a mixture of aluminium powder, aluminium oxide, &c., and heating for a period of some hours. As a result the

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aluminium was absorbed by the steel and the aluminium-rich layer at the surface had the effect of rendering the steel particularly resistant to oxidation when heated in air.

Another way of applying aluminium to steel was to electro-deposit a thin coating of cadmium on the steel, which was then preheated slightly and dipped in a bath of molten aluminium. The cadmium coating presumably melted and vaporised, permitting the access of the molten aluminium to the steel in the absence of air. When the steel article was removed from the bath it had a coating of aluminium resembling that of tin or zinc on work removed from hot-tinning or hot-galvanising baths. The aluminium-coated iron was very resistant to oxidation at elevated temperatures, and to corrosion at normal temperatures, as mentioned by Evans.

Nickel electro-deposits on aluminium had proved capable of affording a fair degree of protection against corrosion, but it was dependent upon the physical character of the deposit, since any discontinuities in the coating formed seats of corrosion of the underlying aluminium. Brook and Stott observed moderate resistance to corrosion of deposits of from 0.0001 to 0.001 in. thickness. H. K. Work had described methods of producing a roughened surface of aluminium and aluminium alloys by the use of etching solutions; his objection to sand-blasting was the equipment required. His nickel-plated samples bearing 0.0005 in. of nickel alone appeared to have given fair results in a salt solution test, *i.e.*, partial immersion in 1 per cent. NaCl, 1 per cent. $CaCl_2$ solution.

Cournot and Eary made corosion tests by partial immersion in artificial sea water, and nickel deposits on aluminium gave fairly good results. It was generally agreed the for the reasonable protection of aluminium and aluminium alloys, nickel deposits required to be free from pores and of moderate thickness. Practical experience of duralumin and aluminium plated with nickel had shown that unless the nickel deposit was moderately thick, *i.e.*, 0.0005 in. or more, and substantially free from pin-holes the deposit might be expected to blister and to become disrupted in places.

Zinc deposits had given promising results, and afforded better protection than nickel deposits under severe conditions. In the author's laboratory blasting with fine sand had been found the most consistent and generally satifactory method of preparing the work. Deposits from sulphate and cyanide zinc baths were being investigated for general and protective properties. At present the sulphate type of bath appeared to be preferable to the cyanide type, since a higher degree of protection was obtainable by the former when used with appropriate addition agents.

Cadmium deposits had given promising results. Cournot considered the cyanide type of bath the best for the purpose and obtained satisfactory results in corrosion tests. he also reported favourably on deposits of chromium on cadmium as a protection against corrosion. In the author's laboratory cadmium deposits had given good results, particularly on aluminium alloys. Although under marine conditions the cadmium of the coating appeared to be removed rather quickly, it appeared to leave a protective coating, probably consisting of mixed oxides of cadmium and aluminium.

The research at the Royal Aircraft Establishment on the use of electro-deposited coatings for the protection of metals against corrosion was now receiving assistance from the Department of Scientific and Industrial Research, and special investigations were in hand for the electro-deposition Committee of the Department.

Discussion.

THE CHAIRMAN (Mr. U. R. Evans) said that the properties of the light alloys were bound up with the invisible surface film, which Mr. Sutton had been the first to isolate, and the study of that film was therefore of great importance. Attempts to plate upon aluminium and its alloys formed an interesting study, since the difficulties in plating upon other metals were magnified, or "caricatured," resulting in valuable information. Coating steel with aluminium to prevent corrosion had been most promising in a comparison which he had carried out between the efficiency of various finishes. There was a big future for aluminium coatings if their performance was satisfactory and cost not abnormally high.

MR. E. A. OLLARD explained that when he was in Berlin in 1924 Dr. Leibreich had shown him a photograph of an aluminium electrode taken at the moment of the reversal of the current, which clearly showed the oxide film curling away from the surface.

DR. R. S. HUTTON (president) said that, although anodic oxidation was not new, *e.g.*, the aluminium rectifier had been known some 20 years ago, the idea had been lying dormant until Bengough and his colleagues at the Air Ministry had brought it to the point of commercial application. There was a very big potential field for the process, and licences to work the process were now being issued to manufacturers, chiefly in the aircraft industry, by the Department for Scientific and Industrial Research. There was also a big future for aluminium coatings, although an electro-deposit which was much thinner might give as good, and even superior, results.

MR. D. J. MACNAUGHTAN, referring to anodic oxidation, said it was essential that no other metal should be in contact with the aluminium being treated; such articles had to be disassembled, then reassembled after oxidation, injury to the film being then prone to occur. There was also the difficulty of suspending the article; also the appearance of the finish on certain alloys, such as duralumin after heat-treatment, was unsatisfactory showing up the crystal structure. The difficulty was to find a reliable process which would give, say, 90 per cent. satisfactory results.

MR. J. W. PERRING said that the variation of voltage could be carried out smoothly by means of one of the several types of device on the market. With regard to the breakdown of the film due to excessive voltage, the same thing occurred in the nodon valve, consisting of aluminium in a tri-sodium phosphate solution; if the voltage were high, sparks could be seen, the site of which showed pits in the aluminium. With that valve when using tantalum in a magnesium sulphate solution the anodic film could be seen to flake away.

MR. S. E. WEILL said the anodic process could now be satisfactorily applied to both aluminium and duralumin. Coloured finishes could be obtained afterwards without difficulty, and there was no difficulty with the generator. The solution was so cheap that it was best to scrap it periodically. The object should be suspended by aluminium wires secured tightly. The big difficulty in plating upon aluminium was that the latter oxidised so readily.

MR. S. WERNICK (hon. secretary) said there was no doubt about the efficiency of the anodic process as a method of protecting aluminium. It did not, however, seem necessary to carry out the step-up in voltage in the exact manner suggested, since he had obtained good results by using fewer stages of voltage adjustment and less time in the bath. He had examined a number of advocated methods of nickel plating upon aluminium some five years ago, but no one gave absolutely satisfactory results. The most promising method made use of an initial coat of iron obtained by a dip in an iron salt, and an aluminium article so plated over five years ago had withstood very well the atmosphere of a laboratory, and had subsequently behaved very satisfactorily in the salt-spray chamber.

MR. H. SUTTON replied to the discussion.

A Train Describing System.

The "B.P. Relay" Railway Signalman's Train Describing and Passengers Platform Indicator Apparatus.

A RAILWAY train describing system has recently been developed by the Relay Automatic Telephone Co., Ltd., in association with the British Power Railway Signal Co., Ltd., that employs some of the great variety of devices and circuits used in automatic telephony switching in application to railway traffic control, in which functional flexibility of the apparatus is a most valuable asset, while the design of the apparatus, consisting exclusively of simple relays, should ensure a high standard of reliability.

The following are typical instances of its application:—A signalman controlling a junction has obviously more than one procedure of passing trains forward, that adopted in each case being determined by the identity of the train. If the traffic is light and the local conditions are such that there cannot be more than one train between his own cabin and the immediately preceding cabin in the "up" and "down" directions, the necessary information may be conveyed to him telephonically, by bell code rings, or other such means. But, the heavier the traffic the more impracticable this procedure becomes, calling for an act of memory on the part of the signalman, which difficulty is claimed to be entirely overcome by the system as hereinafter explained.

A train description equipment becomes a necessary adjunct to the signalling system whenever the latter is such that several trains may be approaching between a signalman's cabin and the cabin immediately preceding it; for example, when the line between the two cabins is divided into several sections controlled by automatic signals.

Staff economies may frequently be effected by permanently closing down signal cabins and installing automatic signals operated by track circuits, which results in the condition referred to above and renders a train description system necessary in order to avoid the additional strain upon the signalman and the risk it involves through having either to memorise, or to write down, the descriptions of so many trains if they are conveyed to him in some other way.

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An outstanding feature of the present system is the use of two wires only between the signal cabins. The method of transmitting train descriptions from one place to another is fundamentally similar to that employed in the Relay Co.'s well-known methods of automatic telephone switching, but it is important to recognise the exceptionally favourable conditions under which transmission is effected in train describing, as compared with the conditions obtaining in telephony. For

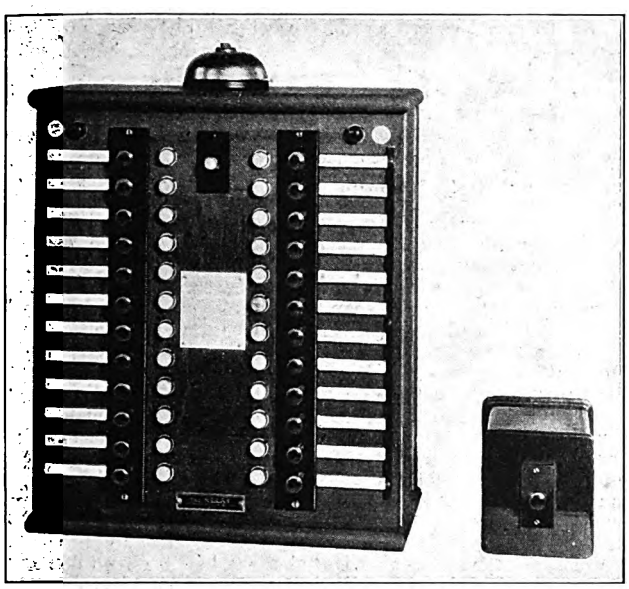

Fig. 1.—Dispatching Key and Lamp Cabinet.

example, in the latter case there can be no control whatever over the number of subscribers who may simultaneously attempt to make calls, and thus it sometimes comes about that momentarily more traffic is being offered than the equipment is designed to accept, with the result that certain of the calls may be lost, or mutilated, to obviate which momentary conditions would entail the provision of plant to an uneconomic extent. In addition, in auomatic telephony impulses are also sent by a great number of different dials, operated by different individuals, sending impulses over lines of different lengths and having different electrical characteristics.

The above remarks enforce the contrast with the conditions obtaining when the train describing system under consideration is used, for it is so arranged that descriptions are always transmitted one at a time from the same transmitting device to the same receiving device over the same line and at a speed which renders faulty transmission almost an impossibility.

Some of the different functions of the system, any or all of which may be embodied in a given set of equipment, are as follows:—

Setting Up.— Descriptions are, in the first place, "set up" by the depression of a key; if desired, an opportunity may be provided for the operator to check the description before actually transmitting it, or setting up and transmission may be effected by the same act.

Transmission.—This takes place on a numerical basis and consists of a series of trains or impulses, 1, 2, 3, or even 4, the

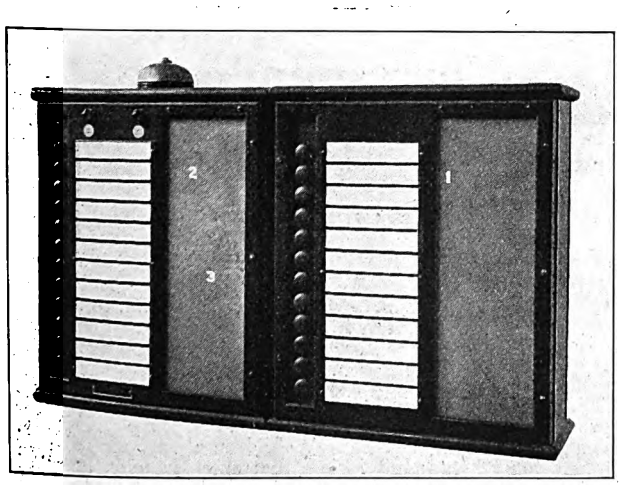

Fig. 2.—Display Cabinet (Receiver).

trains employed depending upon the basis of operation of the particular equipment. The descriptions may be transmitted either to one cabin, or simultaneously to a series of cabins, and remain displayed for the time being at the transmitting end as a reminder to the operator of the last train sent.

Receiving Equipment.—It may be designed to store any number of descriptions and so arranged that as many of the descriptions as may be desired may be displayed in the order of their arrival.

Re-transmission.—Re-transmission of descriptions from the receiving cabin may be effected either by the momentary depression of a key, or by the operation of a track circuit by the train itself; in any case it is not necessary again to set up a description which has been received. A receiving cabin's operator may himself set up descriptions which have not been received and transmit them in advance of the descriptions already stored and displayed in his apparatus. In any case when the receiving operator either re-transmits a description, or interpolates one of his own, the description last sent can be arranged to remain displayed for the time being as a reminder to the operator. The receiving operator can also, if desired, by the depression of a key eliminate descriptions from his apparatus without transmitting them.

Closing Cabins.—It may be arranged that on operating a locking key descriptions received in the signal cabin will be automatically transmitted, thus enabling the cabin to be closed down at times of light traffic without affecting the operation of the train describing system.

The 24-Way System.—Our illustrations show equipment which has already been supplied to one of the British railways, which is designed to cover 24 different descriptions, they being engraved on the labels shown in figs. 1 and 2. This particular equipment is operated upon a 3-digit basis and is thus capable of dealing with a thousand descriptions, each of which would be transmitted as a number. Since only 24 descriptions are actually made use of, the margin of safety against false descriptions is wide indeed, but in the remote event of a fault in transmission the apparatus will display the fact under the description "fault."

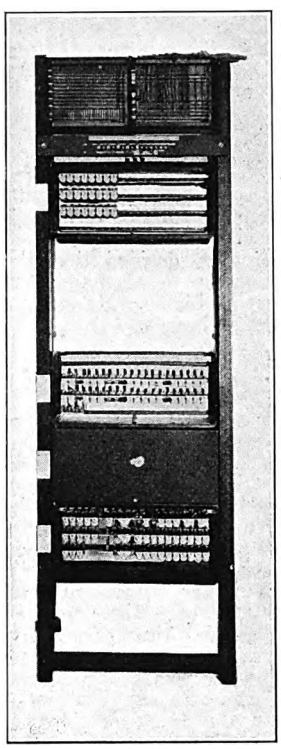

Fig. 3.—Dispatching Apparatus Rack.

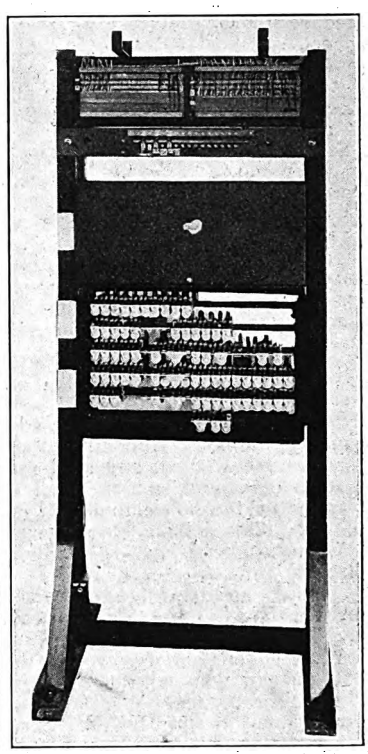

Fig. 4.—Receiving Apparatus Rack.

Referring to fig. 1, the depression of any key causes the corresponding description to be at once transmitted from the apparatus shown in fig. 3; when completed (at the most in two seconds) a lamp associated with the key lights and remains alight until the key is depressed to send a further description.

The receiving equipment in the present instance is designed to store six descriptions and display three of them, so that six descriptions may be sent before the receiving equipment becomes full up. If it is attempted to send a seventh description, the depression of the key for that purpose will be quite ineffective, except that the red alarm "line lamp" in the left-hand top corner of the display cabinet will light and remain alight only for so long as the distant receiving equipment remains full up. The separate key shown in fig. 1 is for the purpose of extinguishing the lamp corresponding to the last train sent when it is not desired to send further descriptions: for example, on closing down the cabin at night.

Figs. 2 and 4 show the receiving equipment, space being provided upon the apparatus rack (fig. 4) for re-transmitting facilities to be added later. The display cabinets merely consist of labels with a common ground-glass screen behind which are fitted stencils and lamps for displaying in the order 1, 2, 3, the next three trains to arrive.

As re-transmitting facilities are not initially provided on this particular plant, the positions for lamps at the left-hand side of the cabinets are for the time being occupied by blanks, but when re-transmission is brought into effect these lamps will constitute a reminder to the operator of the last description re-transmitted.

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Platform Indicators.—It will be obvious that the apparatus has all the elements required for the purpose of platform indication to the public. merely by the construction of the apparatus shown in fig. 2 in a suitable form.

Numerical Displays.—Our illustrations show a form of display which may be termed descriptive, the 3-digit number employed for the transmission of any given description resulting in the lighting of an individual lamp much in the same way as the number employed in automatic telephone systems results in the ringing of an individual bell. However, it is quite simple to display the descriptions in their numerical form, either upon a 1-, 2-, 3-, or 4-digit basis as may be required by particular conditions.

Legal.

Willesden U.D.C. v. Whittaker Ellis, Ltd.

THE hearing was resumed and concluded at the Marylebone County Court on November 15th, before Judge Snagge, of the action in which the Willesden Urban District Council sued Messrs. Whittaker Ellis, Ltd., of 121, Victoria Street, Westminster, S.W., public works contractors, to recover £44 4s. for loss sustained through the alleged negligence of the defendants' servants. The claim set out that on March 6th last the defendants, acting as contractors for the Metropolitan Water Board, were working in High Road, Church End, Willesden, being engaged in opening the road for the purpose of tracing and repairing a leak in a water pipe. It was alleged that the workmen engaged on the work were negligent in that they allowed an instrument to damage a h.p. cable, allowing the water to enter it, which caused a short circuit. Owing to this, 27 yd. 2 ft. of the electric cable was rendered useless, and the plaintiffs claimed £44 4s. in connection with this and loss sustained. The defendants denied that their servants were negligent in causing the short circuit, and further denied that any wedge or other workman's instrument caused the damage alleged.

Judge SNAGGE, after a lengthy hearing, decided that the wedge had entered the cable, so causing the damage, but absolved the workmen concerned from all blame. He entered judgment for the plaintiffs for £44 4s. and costs.

Lamps Ordered by Telephone.

THE obtaining of goods by fraud, in many trades, has been causing trouble at Huddersfield and other West Riding towns for two years or so, and as a result of recent complaints in respect of electric lamps, local electrical dealers have been warned by the police to be on guard against orders by telephone, followed by a messenger. When Mr. Frank Hirst, a Dewsbury electrician, received an order for three dozen electric lamps to the value of £6 3s. recently, the police were informed, and arrested Douglas Whitaker, Bradford, and Martin Hewitt, electrician, Bradford. Meanwhile, between the Dewsbury order and arrest, Messrs. Alfred Crowther, Ltd., Huddersfield, received a telephone order for 50 lamps, and the boy who called for the lamps was followed by detectives. The order to the Dewsbury firm was supposed to be for a local picture house. That to the Huddersfield firm purported to be from Mr. T. W. Broadbent, electrician, of East Parade, who was supposed to need the lamps for a mill job. Neither the picture house manager nor Mr. Broadbent had given any such orders. With regard to the Huddersfield case, Hewitt was last week sent to prison for three months, though he denied all knowledge of the matter. At Dewsbury last week Hewitt was fined 19s. 6d. for assaulting a detective, and both men were committed to the next Quarter Sessions on a charge of fraud.

Compensation Claim Follows Fatal Shock.

IN the Hull County Court on November 12th, Thomas Drust, Hessle, claimed the sum of £150 from Messrs. Watshams. Ltd., Victoria Street, S.W.1, as compensation for the loss of his son, Sidney Drust, who received a fatal electric shock while in the respondents' employment.

Counsel for the applicant said that the claim was resisted on the grounds that the injury was not caused by an accident arising out of deceased's employment, and that the claimants were not dependent (wholly or partially) upon the deceased. The accident occurred while deceased was working on an overhead line. He had been instructed, with another man, to straighten a pole and was told to wait until a foreman arrived. To save time Drust did not wait, but climbed the pole to place a guy rope over the top. He came into contact with a 22,000-V line and was seriously burned and he fell and fractured his leg.

Evidence was given for the respondents to show that the deceased had neglected to observe his instructions, and that it was no part of his duty to climb poles. Moreover, the men had been warned that the line was "live."

Judge BEAZLEY, after hearing the evidence, reserved his judgment.

Theft of Copper Wire and Cable.

THREE men were sentenced at Ayr Sheriff Court on November 14th to 30 days' imprisonment each, and another to 40 days, for the theft of copper wire and cable from the Ayrshire Electricity Board's yard in Irvine on November 6th.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Telephone Developments.

On November 12th MR. D. G. SOMERVILLE asked the Postmaster-General if he could state at what date he expected that all exchanges in the London area would be converted to the dial system; what was the estimated aggregate cost and duration of the original conversion scheme; and what would be the additional cost as a result of its acceleration.

MR. LEES-SMITH said that, normally, the conversion of a manual to an automatic exchange did not take place until its capacity was exhausted or until the economic life of the plant had expired. The date of complete conversion of the London area to automatic working depended, therefore, to some extent on the rate of growth of the demand for telephones. About 130 exchanges were expected to be working on an automatic basis by 1940, when about 20 exchanges would remain for conversion. The programme was necessarily tentative, and while progress up to the present had been rather more rapid than was anticipated there had been no departure from the principles on which it was regulated. Any deliberate acceleration beyond the needs of the service would involve heavy wastage of capital. On the basis of present prices the expenditure on buildings and equipment for automatic exchanges up to 1940 would be of the order of £25,000,000, of which (for the reasons stated) a large part represented ordinary replacement and development liabilities which would be necessary under manual conditions.

MR. LEES-SMITH informed Mr. Ross that schemes were in hand for improving telephonic communication between Belfast and Glasgow, and the Northern Ireland portion of the work would begin next year. The total cost was estimated at £233,600 of which the Northern Ireland portion amounted to about £40,000, divided nearly evenly between duct work and cabling.

MR. BOWEN asked, whether the telephone construction works announced by the Lord Privy Seal were additional to the normal programme for the year.

MR. LEES-SMITH said that they were an acceleration. The authorised construction programme for the current year amounted to £10,500,000. Works estimated to cost £750,000 in addition to this authorised programme had now been sanctioned and would be put in hand forthwith.

On November 13th SIR F. THOMSON asked what was the sum that the Post Office had standing at the credit of telephone users on deposit for trunk calls.

Mr. VIANT, the Assistant Postmaster-General, said that the total amount held on deposit on September 30th, 1929. was £2,690,717. This covered local calls and phonograms as well as trunk calls.

Correspondence.

Correspondents should forward their communications as early as possible. *No letter can be published unless we have the writer's name and address in our possession.*

The "All-Electric" House.

Your special issue of October 18th contains so much interesting matter that I have only to-day found time completely to digest it.

As one would anticipate, the "all-electric" house is well in the foreground, and I have been particularly intrigued by the articles appearing under the names of Professor S. Parker Smith and Mr. H. Willoughby Ellis.

The latter gentleman kindly presents me with a text for my few remarks when he says "no good purpose is served by remarking that the shoemaker's children always wear the most broken down boots; but it is a matter of common knowledge (and nothing to our credit) that electrical men have been woefully slow to set an example to the rest of the community in the matter of employing all-electric domestic service in their own homes."

It is evident that there must be some good reason for this action, or rather want of action, on the part of electrical men. and very respectfully I would submit that the reason lies in the fact that the majority of electrical engineers realise that with the present system of deriving electrical energy from coal, it may be said to constitute an offence against the rules of national fuel economy to use electrical energy for such pur-

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poses as heating rooms and hot water supply. I need not quote to the readers of a technical electrical journal the actual percentage of heat units lost during the process of the generation of electricity from coal, as this is only too well known.

In the course of many discussions with electrical men in all branches of the industry I have, however, found to my intense surprise that this offence does not lie heavily on the consciences of many, and that, as a matter of fact, many electrical engineers consistently turn the blind side of their brain towards it.

However, the offence against national economy is borne out by the financial results, and I propose now to briefly refer to this aspect of the question.

The reading of Professor S. Parker Smith's classic paper in 1925 had a rather unexpected effect on me personally.

At that time I was considering the re-organisation of the domestic services in my house, which contains the same number of rooms as Professor Smith's, and, as a result of the figures given in the original paper, turned my face resolutely away from the "all-electric" house.

Instead, I adopted what might be called the "gas-coke" house. For use during the six months of winter, I installed in the kitchen a coke-fired boiler, which supplies hot water without stint for all purposes and at the same time feeds radiators in the hall, study, and bathroom. The radiator in the hall is of such dimensions as to be capable of keeping the general temperature throughout the house at about 50 deg. F. during the most arctic weather.

For use during the summer months when hot water supply only has to be considered, a small gas boiler takes the place of the large coke boiler.

In the dining room one coal fire still survives, largely for sentimental reasons. In the remaining rooms, not provided for by the radiators, gas fires are fixed. For cooking, a modern gas cooker fitted with a temperature regulator gives entire satisfaction to my wife, whose opinion on this point is the only one which matters. Light is provided by a small gas engine driving a little generator, which costs a ridiculously small amount for annual running.

Unfortunately, I am not able to give the results for five years, as the system was only put into service at the beginning of 1927, but I am able to give them for three years, 1927, 1928, and 1929. They are as follows:—

Coal, coke, firewood, and gas.

1927	£23	10	0
1928	25	4	2
1929	20	9	7
	£69	3	9
Average for three years ...	£23	1	3

The average cost in Professor S. Parker Smith's all-electric house, which is situated in a district which provides a supply of electricity at the phenomenally low price of .64d. per unit, is, roughly, £43.

Apart from the very substantial saving effected in annual cost, there is the advantage that no special means have to be provided for ventilation. The gas and coal fires provide naturally for ample air circulation. I note that in the all-electric flat described by Professor Smith it was necessary to block the flues in order to enable a sufficient temperature to be reached in the rooms.

In conclusion, I must express my admiration of the thorough and painstaking way in which Professor Smith has carried out his large-scale experiment on electric domestic service. If the electrical energy were produced economically by water or wind power, I should be most enthusiastic in my adoption of the same system in my own house.

It seems to me, however, that the first duty of an electrical man is to be an "engineer," and the definition of an engineer which appeals most strongly to me is "one who most efficiently utilises the resources of nature."

I feel strongly that it is not in the best interests of the electrical industry in the long run to push the use of electricity for heating purposes irrespectively of the method by which the electricity is generated, and am convinced that if this is done recklessly the chickens will come home to roost.

Frank J. Moffett.

Birmingham, *November 12th*, 1929.

Correction of Balance by Induction Motors.

My best thanks to your correspondent, "Delta," for his prompt and careful reply to my query in the ELECTRICAL REVIEW of October 18th *re* induction motors. It is the knowledge that such help is waiting which encourages those who, like myself, "come up against it" now and again to bring their difficulties forward.

Student.

November 11th, 1929.

Potential Connections for Automatic Voltage Regulators.

I have read with great interest the article on the above in your current issue, in which Mr. G. W. Stubbings describes how an unsymmetrical three-phase system comprises a symmetrical system plus a superimposed single-phase component representing the voltage drop due to the out-of-balance current, and gives particulars of a scheme of connections in conjunction with a voltage regulator for maintaining approximately average voltage on the three phases in the event of a large overload or short circuit between two phases.

It would be of interest to see how the single phase component is obtained, say, for unequal loading on two pairs of phases, and also for a short circuit between one phase and earth, when the earth is connected to the neutral point. The tendency of the regulator in any case would apparently be to give the alternator associated with it an increased voltage across one pair of phases to compensate for the drop on the other two.

As a matter of fact, I have always found that in the event of a short circuit a regulator has no time to regulate at all. The contacts simply come together and short circuit what resistance is connected between them, and simultaneously the faulty feeder or apparatus is tripped out, since in this country protective systems have attained a high degree of perfection, and are in general use.

It would appear, therefore, that during the few moments the short is "on" it would be more advisable to keep the voltage on the low side instead of feeding the fault with a higher voltage, and that, when perhaps a large load has been tripped off the generator as the result of the short circuit, the regulator should immediately respond to bring the voltage down to normal.

In an article on voltage regulators which appeared in the *Metropolitan-Vickers Gazette* of June, 1926—since reprinted in leaflet form—I described a device which limited the excitation of an alternator to a predetermined value during a short circuit on the system, and at the same time allowed the regulator to operate and keep the voltage down to normal upon the load tripping off. The usual single-phase control from one pair of phases is used, and the device is operative upon a sudden drop, or a sudden rise, in pressure, so that it is effective whatever the phase upon which the fault occurs. It has been found that the whole load may be tripped off an alternator after a severe short circuit without more than a momentary drop and rise of limited magnitude being recorded on the voltage chart.

H. E. Angold.

Streatham Vale, S.W.16.
November 12th, 1929.

Two-part Tariff Prepayment Meters.

The description published by you last week of the "Rex" two-part tariff repayment meter shows the latter to contain an ingenious mechanical contrivance, enabling supply authorities to collect only small fixed charges. The amount thus prepaid would often be sufficient to cover the rent of the meter, *viz.*, about 2s. per quarter, but would hardly ever result in the prepayment of sums as large as 10s. or £1 per quarter. Many meter engineers do not yet seem to realise that the object of a two-part tariff system is to increase the amount of electricity sold, by reducing the price of the kWh. It is then, of course, necessary to impose a fixed charge in addition to the unit charge. To reduce the unit charge from, say, 5d. to 1½d., it is necessary to make a fixed charge of about 15s. per quarter. In the meter described a consumer could insert, say, five shillings, half of which would go towards the fixed charge and half to cover the unit charge. At 1½d. per unit the consumer would thus be allowed to take 2s. 6d. divided by 1½d., *i.e.*, 20 units. With a little care this could be made to last out the quarter, and the collector would have to whistle for his 12s. 6d. I am afraid, therefore, that the "Rex" meter is unsuitable for this purpose, unless the authorities are content to ask for the odd twelve shillings of fixed charge still unpaid before closing the switch. In that case they would do better, of course, to use a non-prepayment meter. I find, on the other hand, that the A.E.G. supplies a real two-part tariff prepayment meter which "does the trick."

H. Horwood,

London, *November 11th*, 1929.

Electrical Thermal Storage.

I was most interested in the description of a "Large Thermal Storage Scheme" at the new headquarters of the London Underground Railways, which was in your issue of September 20th. There are lots of points, however, on which one would like information, or perhaps it would be better to say which one would like explained. I am naturally interested in this branch of the subject, as I made and installed the first hot-water system that I know of, and certainly the first in this country, in 1904. From all the experiments I have made, and from the installations I have put in, the large diameter squat cylinder has always been very low in efficiency. The majority of our own systems are put on the high-pressure mains, and all cylinders are tested to 300 lb. per sq. in. The 18½-in. diameter size has plates 9/32 in. thick, with dished ends 5/16 in. thick. The cylinders are galvanised inside and outside after manufacture. The largest installation carried out so far, of course, compares in no way with the one you describe, but it is for providing 1,000 gallons of very hot water every twenty-four hours.

Apparently no circulating tubes of any description are used in the cylinders, and one would have thought that a battery

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of elements of such a high capacity as 336 kW would cause trouble.

I have found that the type of element described in the article is not at all satisfactory in this country, and it must be very inconvenient to have to replace a broken or burnt-out element. Our own experience with the direct immersion type has been a failure of eight out of 2,000. Some of the elements have been used continuously for fourteen years. There is another point one would like to have information on, and that is that the insulation round the tank appears to be far too thin, as we take it that the temperature of the incoming water will be as low as 40 deg. sometimes. We ourselves never use less than 6 in. of cork insulation on such a small storage system as 1,000 gallons. One would have thought that for such a large installation as this, the 11,000-volt, 3-phase system would have been used direct in the water, and it would be interesting to know the reasons for its non-adoption. It would also be very interesting indeed to hear if the efficiency of this system has been tested, and what it is. We get not less than 85 per cent. efficiency normally, and we have had as high as 89 per cent. efficiency.

The technical descriptions in a paper like the ELECTRICAL REVIEW are always most interesting to some of us who are supposed to be tucked away in the back veldt, but who are always looking for opportunities for keeping abreast with the times.

A. Vaux.
for ALBERT VAUX, LTD.

Cape Town, S. Africa.
October 25th, 1929.

[We forwarded an advance proof of the above letter to Messrs. Richard Crittall & Co., Ltd., whose reply is as follows. —EDS. ELEC. REV. :—]

We agree with your correspondent's remarks with regard to the inefficiency of large diameter squat cylinders. Those installed at Railway House, however, cannot be described in this manner, since their diameter is practically the same as their height; but in any case considerations of space in this instance determined the shape of the storage vessels. Our experience, supported by that of specialists in the manufacture of heat-insulating material, indicates that very little is to be gained by increasing the thickness of this special type of insulation beyond three inches. The same remark, of course, does not apply to less efficient forms of insulating material.

We also agree that for large installations of this kind there will be many instances in which the electrode type of boiler connected direct to the 11,000-volt system could be used. In this instance, however, the Underground authorities gave the matter very careful consideration, and for various reasons, into which it would not be possible to enter except at great length, decided to use a low-voltage immersion-heater system.

Richard Crittall & Co., Ltd.,
D. BETTS, *Sales Manager.*

London, *November 12th*, 1929.

Cross Field of Single-phase Motors.

I was interested to read the letter on this subject from "Eee Bee" in your issue of November 8th. The difficulty which he mentions is one which I recollect coming up against myself, and doubtless many others have noted it, although I have not before seen it stated in print.

Unfortunately many text-book writers content themselves with a rather superficial explanation of the theory of the single-phase induction motor, and do little more than call attention to the fact that the movement of the rotor conductors in the stator field is instrumental in setting up a cross field. The student is left to reconcile as best he can with this statement the fact that owing to the angular movement of such conductors, combined with the lag between current and voltage in them, such a voltage of rotation would, apparently, give rise to a flux which would be in opposition to, and not at right-angles to, the main field.

It is not intended for a moment to imply that the writers of such text-books themselves fail to understand the theory of such a motor, but, unfortunately, an explanation sufficiently full and complete to make the matter clear to the majority of students takes up a very considerable amount of space, which many writers might be more ready to devote to it if they realised how much the condensed explanation sometimes serves to mislead.

Perhaps the following explanation, necessarily very incomplete, may serve to put your correspondent on the right track to a solution :—

In this the rotor conductors are assumed to be separated into two bands, at right angles to one another, and to be rotating at synchronous speed in the alternating flux set up by the stator windings. Owing to the high inductance of the rotor conductors, currents induced in these lag 90 degrees behind the e.m.f.'s.

By following out the currents and e.m.f.'s induced in each belt of conductors during one complete revolution, it can be seen that these currents, being in conductors which are mutually at right angles to each other, and being out of phase by 90 degrees, set up a rotating field, the direction of rotation of which is opposite to that of the rotor itself. This can best be followed out by drawing a series of simple diagrams showing the two belts of rotor conductors in eight different positions during one revolution; the direction of magnetisation of the current in each case being indicated by a vector.

Such a rotating field can itself be resolved into two alternating components, one at right angles to, and one in opposition to, the stator field. That in opposition can be subtracted from the main field, and for the moment disregarded; that at right angles combines with the stator field, as though set up by the second phase of a two-phase motor, forming a true rotating field whose direction of rotation is the same as that of the rotor.

For the motor to develop a torque sufficient to overcome losses when running light, it must, of course, rotate at a speed slightly below synchronism.

The matter is too complicated to be dealt with in a satisfactory manner in so small a space, but the above may serve to indicate what is probably the most satisfactory method of approaching the problem.

C. Coppock.

London, W.C.1.
November 11th, 1929.

The Evolution of Railways.

From September 14th to September 21st, 1930, Liverpool will be celebrating the centenary of the opening of the Liverpool-Manchester railway. From this railway sprang, of course, the first great railway system, the London & North Western, from which developed the huge network of railway systems which has spread all over the world.

Included in the scheme are special pageants, both railway and civic, a comprehensive "Evolution of Transport" procession, and two exhibitions. Of these exhibitions, the first will comprise the heavier exhibits—railway locomotives, rolling stock, &c.—dating from the beginning of railway history. The second will comprise railway posters, historical literature, railway prints, etchings, and models.

The executive committee—which consists of representatives of the civic and railway interests—would be grateful for information from everyone who could supply information as to the whereabouts of historical exhibits, or who would be prepared to lend such exhibits.

Communications should be addressed to me at the undermentioned address.

Arthur Stery,
General Secretary,
LIVERPOOL-MANCHESTER RAILWAY CENTENARY CELEBRATIONS COMMITTEE.

357, Royal Liver Building, Liverpool.
November 15th, 1929.

Meter Jewels.

The main object of our letter was to point out that the statistics given by the author proved conclusively that oiled meter jewels were far superior to dry ones, in spite of his own opinions on the matter. This anomaly was mentioned in the I.E.E. discussion.

The theory put forward, that the oil film does not remain under the pivot owing to the weight of the rotor and small pivot surface, has been exploded by an experiment of Prof. Schachenmeier at the A.E.G. Meter Laboratory.

The above-mentioned statistics certainly support the results obtained from this experiment.

A.E.G. Electric Co., Ltd.

London, *November 15th*, 1929.

Selling Time Switches.

With reference to the E.D.A. meeting on Friday of last week, when salesmen were advised to learn the many applications of the use of time switches, I should like to point out that after the salesman has learnt the more useful attributes of his profession, *i.e.*, cookers, water heating, all kinds of domestic appliances, types of fittings for various house decoration schemes, wiring requirements, to service the appliances, &c., &c., he might be able to turn his attention to time switches.

One of the speakers enjoined salesmen to learn the art of public speaking, pointing out that he had addressed an electricity department's meeting where approximately 150 people gathered to hear him.

To get to the point, if the headquarters of the E.D.A. can only muster a gathering of 60 people, and a small town can command 100 to 150, the E.D.A. has surely something to think about other than advising people on abstruse time switches and the art of public speaking.

Anyone going along the Old Kent Road must notice there is a tremendous field for instructing people in the desirability of the use of electric lighting.

Can we not have subjects of rather more pressing importance than those given at the last two addresses? The gatherings may otherwise dwindle down to zero.

I do not mean to imply that the speakers were poor; indeed, anyone knowing Mr. Sharp, knows that he is delightful.

F. A. Dracup,
Sales Manager, ELECTRICITY DEPARTMENT,
Eastbourne, *November 16th*, 1929.

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Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken

1928.

11,608. "Sound-reproducing machines." A. F. Sykes. April 19th, 1928. (320,868.)
11,712. "Magnetic alloys." Siemens & Halske Akt. Ges. May 20th, 1927. (290,658.)
11,853. "Variable condensers." L. Rouzet. May 10th, 1927. (290,219.)
11,985. "Automatic regulation of the power factor in electric alternating-current systems." Switchgear & Cowans, Ltd., and D. Firth. April 24th, 1928. (320,897.)
12,385. "Secondary electric cells." L. A. Levy and Almeida Accumulators. April 27th, 1928. (320,916.)
12,456. "Intermittently-illuminated direction indicators for motor vehicles." B. Hibbert. April 28th, 1928. (320,917.)
15,005. "Controlling arrangement for electric ship propulsion systems." Akt. Ges. Brown, Boveri et Cie. May 25th, 1927. (281,056.)
15,460. "Methods of producing printing plates by electro-chemical processes." Dr. C. Schinzel. May 25th, 1927. (291,063.)
17,781. "Vacuum-electric tube devices." E. Y. Robinson and Associated Electrical Industries, Ltd. June 19th, 1928. (320,849.)
17,886. "Automatic electric circuit controllers." E. Kieback and P. Peter (trading as Kieback & Peter Messgerate und Regler, Dipl. Ing., firm of). June 21st, 1927. (292,538.)
17,933. "Mercury-arc rectifiers." British Thomson-Houston Co., Ltd., and F. P. Whitaker. June 20th, 1928. (320,850.)
18,287. "Thermionic valve modulation circuits." Siemens & Halske Akt. Ges. June 24th, 1927. (292,626.)
18,293. "Automatic telegraphic reperforators." Muirhead & Co., Ltd., F. H. Muirhead, and J. V. Foll. June 23rd, 1928. (320,870.)
18,500. "Automatic reclosing circuit-breaker systems." British Thomson-Houston Co., Ltd. June 27th, 1927. (292,957.)
18,657. "Automatic reclosing circuit-breaker systems." British Thomson-Houston Co., Ltd. June 27th, 1927. (292,960.)
20,825. "Electric switches." A. D. Constable and A. E. Frankling. July 18th, 1928. (320,857.)
21,142. "Motion-picture apparatus." W. E. Beatty (Bell Telephone Laboratories, Inc.). July 20th, 1928. (320,872.)
21,172. "Systems of control for alternating-current electric motors." W. E. Beatty (Bell Telephone Laboratories, Inc.). July 21st, 1928. (320,889.)
21,209. "Electric lighting and installations for railway and like vehicles." J. Stone & Co., Ltd., and A. E. Honey. July 21st, 1928. (Cognate application 6,331/29.) (320,922.)
21,305. "Switch arrangement for line intercommunication switches with multiple lines." F. Merk. July 23rd, 1928. (320,923.)
21,314. "System and apparatus for the electrical recording and reproducing of sound." A. J. Stephens (M. H. Loughbridge). July 23rd, 1928 (320,893.)
21,315. "Systems for recording and reproducing pictures and sound." A. J. Stevens (H. T. Leeming). July 23rd, 1928. (320,900.)
21,323. "Cascading apparatus, comprising a series of rotatable retarders." R. V. Farnham. July 23rd, 1928. (320,874.)
21,332. "Switching apparatus, particularly applicable to automatic telephone systems." F. Merk. July 23rd, 1928. (320,875.)
21,336. "Electric discharge tubes." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). July 23rd, 1928. (320,876.)
21,337. "Electric fuses." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). July 23rd, 1928. (320,895.)
21,346. "Electric plug-and-socket contacts." K. Schnell. October 6th, 1927. (298,219.)
21,445. "Time-controlled and operated electric switches." J. D. Hindley Smith and S. H. Holmes. May 24th, 1929. (320,813.)
21,505. "Alternating-current motors." H. Weichsel and B. McCormick. July 24th, 1928. (320,901.)
21,545. "Two-position non-spill galvanic cells." Three Star Accumulators, Ltd., and F. C. Grund. July 25th, 1928. (320,903.)
21,553. "Automatic or semi-automatic telephone systems." Standard Telephones and Cables, Ltd., E. P. G. Wright, J. H. E. Baker, and C. M. Colebrook. July 25th 1928. (320,905.)
21,578. "Control apparatus for combined electric lighting and heating or like installations." A. C. Johnson. July 25th, 1928. (320,908.)
21,615. "Induction dynamo-electric machines." J. F. Gill and J. N. Chaviara. July 25th, 1928. (320,931.)
21,707. "Earthing devices for the metallic sheathings of electric resistance elements." Hotpoint Electric Appliance Co., Ltd., and W. J. Sims. July 26th, 1928. (320,936.)
21,732. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., R. Taylor, and L. M. Simpson. July 26th, 1928. (320,938.)
21,874. "Apparatus for forming the depolarising element of primary electric cells." V. E. Richards. July 27th, 1928. (320,942.)
21,879. "Wireless receiving and analogous circuits, and thermionic valves therefor." F. E. A. B. Sewell. July 27th 1928. (Cognate applications 23,287/28 and 6,835/29.) (320,944.)
21,934. "Telephone transmitters." Standard Telephones and Cables, Ltd., L. C. Pocock, and R. Blackburn. July 28th, 1928. (320,950.)
21,976. "Band receiving systems for wireless-telephony and the like." Vreeland Corporation. August 1st, 1927. (294,939.)
22,163. "Telephone systems." Associated Telephone and Telegraph Co. October 21st, 1927. (299,033.)
22,211. "Cathode-ray oscillographs." E. H. Norinder. August 9th, 1927. (295,321.)
22,217. "Electric protective systems." A. Reyrolle & Co., Ltd., H. Leben, and N. Cooke. July 31st, 1928. (320,968.)
22,218. "Electric protective systems." A. Reyrolle & Co., Ltd., and H. Leben. July 31st, 1928. (320,969.)
22,436. "Electromagnetic couplings." A. Lindahl, A. M. V. Hultgren, and S. H. Ahde. Novel ber 3rd, 1927. (299,864.)
23,153. "Electromagnetic devices for reproducing sound from records." S. G. Brown. August 10th, 1928. (320,981.)
23,309. "Manufacture of electric batteries." A. Helbronner and E. Dutt. August 11th, 1927. (295,589.)
23,319. "Magnetos." Wico Electric Co. April 9th, 1928. (309,401.)
24,349. "Devices for the electrical treatment of poultry." O. G. Culverwell. August 24th, 1928. (320,992.)
24,391. "Television system incorporating transmitting and receiving apparatus with cathode rays." D. N. Sharma August 24th, 1928. (320,993.)
24,434. "Method of introducing highly-active metals into sealed containers." Westinghouse Lamp Co. September 9th, 1927. (296,781.)
24,686. "Television." J. S. Shinton. August 28th, 1928. (320,999.)
25,372. "Mercury lamps." J. Harden. September 4th, 1928. (321,003.)
25,903. "Electrical heating and mixing apparatus." Drysdale & Co., Ltd., and J. Young. September 10th, 1928. (321,006.)
25,973. "Transformers for use in rectifier installations." Akt. Ges. Brown, Boveri et Cie. September 10th, 1927. (296,996.)
27,667. "Method of, and arrangement for transmitting wireless signals." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). September 26th, 1928. (321,025.)
27,875. "Coil-driven loud-speakers." C. J. Nesbitt-Dufort and O. & S. Oilless Bearing Co., Ltd. September 28th, 1928. (321,027.)
28,081. "Tubular electric incandescent lamps." E. R. Grote. October 1st, 1928. (321,092.)
28,449. "Thermionic valves or vacuum-electric devices." W. Holt. October 4th, 1928. (321,037.)
29,457. "Combined television and sound-reproducing apparatus." S. F. Warren. October 12th, 1928. (Cognate application 36,212/28.) (321,043.)
30,547. "Thermionic valves." Telefunken Ges. für Drahtlose Telegraphie. October 21st, 1927. (299,325.)
30,640. "Devices for the generation of audio-frequency electric currents." Coventry Automatic Telephones, Ltd, and E. P. L. Westell. October 23rd. 1928. (321,052.)
31,498. "Graphite and depolariser plates for galvanic cells." Siemens and Halske Akt. Ges. October 31st, 1927. (299,784.)
31,816. "Polyphase asynchronous motors." Siemens-Schuckertwerke Akt. Ges. November 4th, 1927. (299,886.)
32,529. "Electrical heating device." S. Thompson. November 7th, 1928. (321,065.)
34,373. "Thermionic valves and the like discharge devices." Telefunken Ges. für Drahtlose Telegraphie. December 6th, 1927. (301,827.)
34,742. "Manufacture of electric incandescent lamps or the like." General Electric Co., Ltd. November 28th, 1927. (301,389.)
34,801. "Cathodes for electron-discharge devices." Dr. A. Just. July 30th. 1928. (316,536.)
34,849. "Reflector arrangement for incandescent lamps." S. K. Olsen (trading as L. Poulsen & Co.). November 24th, 1927. (Addition to 280,351.) (301,332.)
36,087. "Fluid-filled paper-insulated electrical cables." W. Brown. December 7th, 1928. (321,088.)
36,318. "Automatic light-changing mechanisms for lighthouses." Austinlite, Ltd. December 10th. 1928. (321,091.)
37,540. "Incandescent electric lamps." G. Main. December 23rd, 1927. (302,917.)
37,971. "Picture and the like telegraph systems." A. Carpmael (Telefungen Ges. für Drahtlose Telegraphie). December 22nd, 1928. (321,104.)

1929.

240. "Electric switches." A. Stuppock and G. Hager. January 3rd, 1928. (303,450.)
850. "Electric motors." Magneto Belge. July 13th, 1928. (315,384.)
1,038. "Miners' electric lamps." J. G. Daloz. July 27th, 1926. (316,281.)
1,571. "Twin and multi-core electric cables." St. Helens Cable and Rubber Co., Ltd., and H. C. Harrison. January 16th, 1929. (321,118.)
3,995. "Electric lamps for the production of ultra-violet rays." W. D. Verschoyle. February 6th, 1929. (Addition to 312,591.) (321,124.)
4,384. "Relay and selector arrangement in telephone installations." F. Merk. March 5th, 1928 (307,340.)
5,041. "Electric discharge devices." Telefunken Ges. für Drahtlose Telegraphie. March 14th, 1928. (307,826.)
5,108. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. February 15th, 1928. (306,099.)
5,266. "Television apparatus." J. L. Baird and Television, Ltd. April 25th, 1928. (Divided application on 320,639.) (320,909.)
5,894. "Electric lampholders." J. B. Taunton. February 22nd, 1929. (321,131.)
7,060. "Means for the synchronisation of broadcast wireless sounds and kinematograph films." C. H. Verity. July 23rd, 1928. (Cognate application 7,061/29.) (320,881.)
9,420. "Television apparatus and the like." J. L. Baird and Television, Ltd. May 31st, 1928. (Divided application on 318,278.) (321,138.)
17,733. "Methods of electrolytically depositing chromium." Soc. Chimique de la Seine and V. Szidon. July 28th, 1928. (Divided application on 320,440.) (320,959.)
20,513. "Method of and apparatus for starting and controlling electric motors." Brookhirst Switchgear, Ltd., and J. A. Hirst. June 16th, 1928. (Cognate applications 20,133/28 and 20,514/29.) (Divided application on 320,615.) (320,882.)
25,955. "Television and like systems." W. E. Beatty (Bell Telephone Laboratories, Inc.). April 26th, 1928. (Divided application on 318,160.) (320,961.)
30,430. "Vacuum-electric tube devices." E. Y. Robinson and Associated Electrical Industries, Ltd. June 19th, 1928. (Divided application on 320,849.) (320,866.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from November 13th :—

Livejuce (lettering and design). No. 506,025. Class 1. Electrolyte for lead-plate electric storage batteries.—The Livejuce Manufacturing Co., 42, South Lambeth Road, S.W.8.

Isomone. No. 504,019. Class 8. Parts of wireless telephonic apparatus.—Haw & Co., Ltd., 845-850, Salisbury House, London Wall, E.C.2..

Viva-Radio. No. 505,387. Class 8. Instruments and apparatus for use in connection with wireless telephony and telegraphy, and wireless telephonic apparatus in combination with gramophones.—The Columbia Graphophone Co., Ltd., 102-108, Clerkenwell Road, E.C.1.

Folio. No. 490,085. All goods in Class 11.—Siemens-Schuckertwerke Gesellschaft, 101-110, Noonendammallée, Siemensstadt, Berlin, Germany. (British representatives: Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, W.C.2.)

Remediolux. No. 506,396. Class 11. Electrical apparatus for use in the production of high-frequency violet rays for surgical or curative purposes.—John W. Vernon, trading as the Cromford Textile Agencies, Cromford House, Crown Place, Market Street, Manchester.

Valunda. No. 506,104. Class 13. Electric switches.—Frederic R. Francke, 28, Blomfield Road, Maida Vale, W.9.

Chaolit. No. 506,055. Class 50. Lamp shades.—McIon J. D. Carter, 25, Cleveleys Road, Upper Clapton, E.5.

Effect of Drought on Water Power in U.S.A.

According to a review by the Statistical Research Department of the National Electric Light Association (U.S.A.), the generation of electricity by water power in September this year was only 31 per cent. of the total output. This is the lowest proportion since the dry weather period of October, 1925, and compares with a proportion of 43 per cent. in May, and 38 per cent. in September, 1928. During the month in question the total hydro-electric production was 12½ per cent. below that of August and 12 per cent. below that of September, 1928. The effect of the reduction in generation by water-power plant is reflected in the fact that 2,600,000 additional tons of fuel have been consumed by the fuel stations in the country during the last few months.

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New Work for Contractors

Particulars of new works and building schemes for the use of electrieal installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ASHFORD (KENT).—Additional 65 houses, for the U.D.C.; surveyor

AYR.—Houses (200), for the Corporation; burgh surveyor.

BARNET.—Electric lighting installation at Byng Road school, for the Hertfordshire C.C. (£150).

BEACONSFIELD (BUCKS.).—Extensions, film studios, for the British Lion Film Corporation.

BENFIELDSIDE.—Remodelling two schools (£11,000); Durham county education architect.

BEXLEY (KENT).—Business stores, Broadway, for F. W. Woolworth & Co., Ltd., Kingsway, London. Houses (60), Long Lane, for Cox Bros., Maidstone. Houses (35), for D. C. Bowyer; A. H. Jennings, architect.

BEXLEY.—Houses (42), Wickham Street, for J. Stevens and Sons; A. Hargreaves, architect.

BILSTHORPE.—Conversion of institute to cinema; Stanton Ironworks Co., Ltd.

BILSTON.—School, Proud's Lane and Mountford Lane; A. F. B. Sidwick, surveyor to U.D.C., Town Hall.

BIRMINGHAM.—Hotel, Yardley Wood Road, for Ansell's Brewery, Ltd.; H. W. Hobbiss, 33, Newhall Street.

BLACKPOOL.—Hospital, Whinney Hall Road, for the Board of Management, Victoria Hospital (£100,000); J. Gibson & Gordon, architects, 5, Old Bond Street, London, W.1. Rebuilding Royal Oak Hotel, Lytham Road and Waterloo Road, for Catterill & Swarbrick's Brewery; Sir Lindsey Parkinson & Co., contractors, Talbot Saw Mills.

BOLTON.—School and parochial hall; rector of St. Mary's R.C. Church, Palace Street.

BOSTON.—School, Skirbeck; Lindsey E.C. Hospital blocks (£7,000), for the Fever Hospital Joint Committee; borough surveyor.

BRAINTREE.—Electric lighting installation, Institution, for the Board of Guardians; clerk. Weaving shed; Warner and Co. Business premises, Bank Street, for F. W. Woolworth & Co., Ltd., Kingsway, London, and Freeman, Hardy & Willis, Ltd., Leicester.

BRIGG.—Alterations and additions to the Grammar School (deposit £3 3s.); H. G. Gamble, county architect, Lincoln

BROADSTAIRS.—Refuse disposal works, with electrical work (£8,598), for the U.D.C.; surveyor.

BROMLEY (KENT).—Housing scheme (60), for the R.D.C.; surveyor.

CLIFTON (YORKS.).—School (400 places), for North Riding E.C.; director of education, Northallerton.

CONSETT.—Houses (50); U.D.C. surveyor.

COULSDON.—Premises, Chipstead Valley Road; Watney, Combe, Reid & Co., Ltd.

CROYDON.—Additional housing schemes (744), for the T.C.; borough engineer.

DARLINGTON.—Employment exchange (£9,500), for H.M. Office of Works, King Charles Street, London, S.W.

DARTFORD.—Additional housing scheme (166), for the R.D.C.; surveyor.

DARWEN.—New central shopping area, Market Street area: borough surveyor.

DEVON.—Schools (40) (£320,000), for the E.C.; J. F. Young, secretary, Exeter.

DUDLEY.—Dairy, Priory estate (£20,000), for the Dudley Co-operative Society, Ltd.

DUNMOW (ESSEX).—Housing scheme (68), for the R.D.C.; J. Plumbley, surveyor, 58, New Street (returnable deposit of £1 1s.).

EDINBURGH.—Buildings at Bellevue Technical School (£11,000); master of works, Education Authority. Synagogue (£22,000); the Rabbi, Edinburgh.

FINEDON.—School, with clinic, for Northants. E.C.; R. J. Williams, architect, Market Street, Kettering (returnable deposit of £2 2s.).

FLEETWOOD.—Bank premises, Lord Street, for Westminster Bank, Ltd.; Lumb & Walton, 19, Clifton Street, Blackpool.

GLASGOW.—College premises, Pitt Street, for the governors, Glasgow and West of Scotland Agricultural College. Cinema, Ardmay Crescent, King's Park; Robert F. M'Math.

GRANTHAM.—School, for Kesteven E.C.; education architect, Sleaford.

GRAVESEND.—Reconstruction, West Street area; borough engineer.

GREAT CHART (ASHFORD, KENT).—Electric lighting installation, Parish Church; Rev. N A. Holt, vicar.

GREENOCK.—R.C. school; executive officer to the Renfrewshire Education Authority.

GUILDFORD.—Houses (44), Westborough estate; borough engineer.

HAMPSHIRE.—Extensions, mental institutions; county architect.

HEMSWORTH.—Laundry, with electrical work, for the Joint Hospital Committee; W. T. Lynam, R.D.C. surveyor.

HOUGHTON-LE-SPRING.—Housing scheme (36), for the U.D.C.; surveyor.

HOYLAKE.—Housing scheme; Hoylake and West Kirby Housing Society, Ltd.

HULL.—Eight schools; director of education.

HYLTON (Co. DURHAM).—Aerodrome; Air Ministry.

ILMINSTER.—Factory, Hort Bridge, for the Ilminster and District Farmers' Co-operative Society; secretary.

IRISH FREE STATE (LIMERICK).—Conversion, with heating and lighting work of Clarina Castle, to tuberculosis hospital, for the County Board of Health.

(DUBLIN).—Electrical installation at city abattoir, North Circular Road; F. McArdle, architect, 29, Rosemary Street, Belfast (returnable deposit of £3 3s.).

(DONEGAL).—New St. Patrick's Memorial Church of the Four Masters; Wm. H. Byrne & Son, architects.

KESWICK.—Sewage disposal works (£17,900); surveyor to U.D.C.

KETTERING.—Re erection of factory, Wood Street, for Loake Bros.

KINCARDINESHIRE.—School at Laurencekirk; clerk, education authority, Laurencekirk.

KIRKCALDY.—Houses (100), for the Corporation; burgh surveyor.

LONDON (BETHNAL GREEN, E.).—Reconstruction, Wilmot Street school (£21,688); L.C.C. architect.

(WEST HAM, E.).—School (1,200 places), Canning Town, for the borough E.C.; C. E. Cranfield, clerk, 95, The Grove, Stratford, E.

(ISLINGTON, N.).—Buildings, Essex Street; B. L. Sutcliffe.

LUTTERWORTH.—Additional housing scheme (40), for the U.D.C.; surveyor.

MALDON (ESSEX).—Housing scheme (95), for the R.D.C.; William Almond, engineer.

NEWBARN (Co. DURHAM).—R.C. school (200 places); Rev. F. W. Savory.

NEWCASTLE-ON-TYNE.—County offices (£90,000); architect, Northumberland County Council, Moothall.

NORTHAMPTON.—School, Bective estate, for the E.C.

NORTH BERWICK.—Cinema (1,100 seats); burgh surveyor.

OSWESTRY.—Houses (50), St. Martin's, for W. Y. Craig and Sons, Ifton Colliery, St. Martin's.

PORTSMOUTH.—Church, Penarth Avenue, Cosham; Portsmouth Diocesan Church Extension Committee.

PURLEY.—Houses (60), Hadyn Avenue; Old Lodge Estates, Ltd.

ROMFORD.—Shopping arcade, South Street; Harrington and Evans, architects, 10, High Street. Houses (68), for P. H. Evans.

SCUNTHORPE.—Senior school, Ashby, for the Lindsey E.C.; director of education, Lincoln.

SKEGNESS.—Senior school, for Lindsey E.C.; director of education, Lincoln.

SLEAFORD.—Extensions to county offices (£8,000), for Kesteven C.C ; county architect.

STONEHOUSE.—School, for Lanarkshire E.C.; director of education, Glasgow.

TUNBRIDGE WELLS.—Schools (£11,000); Rev. Canon A. W. Oliver.

WALSALL.—Houses (132), for the T.C.; George Insley, Ltd., builders.

WARWICKSHIRE. — Nurses' home, mental hospital (£13,330); county architect.

WELWYN GARDEN CITY.—Housing scheme (200), for the U.D.C.; surveyor.

WINCHESTER.—Houses (50), with electrical work, for the T.C.; F. G. Bursill, builder, Warwick. Central depôt (£2,245), for the T.C.; city engineer.

WITHAM (ESSEX).—Housing scheme, for the U.D.C.; D. Jenkinson, surveyor (returnable deposit of £2 2s.).

WOLVERHAMPTON.—Erection and repair shops, with warehouse and electrical eequipment (£500,000), for the Great Western Railway Co.; engineer.

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The ELECTRICAL REVIEW

FOUNDED 1872

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See p. xxvii.

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See p. vii.

INSTRUMENTS, CIRCUIT-BREAKERS,
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UP TO 132,000 v.
are guaranteed to extinguish the arc and clear any short in the first half cycle.
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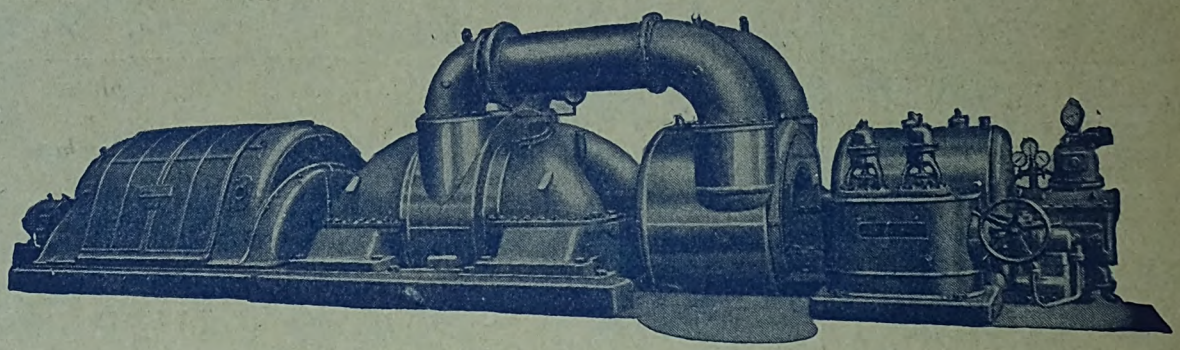

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The

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Low-temperature Carbonisation.

THE production of electricity is, from the thermal aspect, admittedly inefficient, and much engineering thought has been devoted to the low-temperature carbonisation of coal as the most promising means of remedying the position. The disappointments which have in the past attended the commercial results of coal pre-treatment make welcome an occasional reminder that steady progress is being made towards a solution of the problem.

The three papers describing recent developments in Great Britain, the U.S.A., and Germany, which were read before the I.E.E. last week, are evidence that this progress is real and also contain promise that this form of coal distillation has an important future. The crux of the situation is, of course, that the capital and operating charges of the pre-treatment plant must be met by finding a market for the gas, tar-oils, and coke at a total price sufficiently in excess of the cost of the raw coal. It is of interest to compare the methods employed in the three cases to secure the requisite surplus. In the Milwaukee plant, which was designed on the basis of experimental work carried out in England, the margin is derived from the sale of gas to an undertaking under the same control, but the price obtained (2s. 6d. per 1,000 cu. ft.) is much in excess of the bulk value of gas in this country. Constancy of operation is obtained by storing the gas and pulverised semi-coke, as the latter can, unlike raw coal, be stored for an indefinite period.

The position in Germany is complicated by the necessity for the efficient utilisation of brown coal from open workings with a low calorific value and a high moisture content; from such coal over 60 per cent. of the kWh sent out by public supply authorities is generated. The tar has a value two and a half times that of the semi-coke, but, as its price fluctuates, the generation of electricity provides the stable basis. Preparations are being made, however, to include public gas supply in the plan of operations. Pit-coal in Germany contains too little tar to pay for its carbonisation in conjunction with electricity works.

The Dunston plant was described in the ELECTRICAL REVIEW of October 5th, 1928. It is the only one of those dealt with that was designed for the direct purpose of cheapening the cost of electricity, as well as that of the economical utilisation of raw coal. The margin required to pay for pre-treatment is obtained from the sale of the

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oils, the semi-coke and gas being credited only at their heat value. The gas (80 B.th.u. per cu. ft.) is burnt under the boilers. It has recently been suggested that another use might be found for the gas in inter-stage steam reheating in the turbine room at a reasonable capital cost and without many of the complications which accompany existing methods.

An important feature of the Dunston plant is that it treats ordinary steam coal, which is cheaper than most coking coals. The cash value of the tar products amounts to 8s. 11d. per ton of raw coal, and, after allowing for reduction in heat value and for losses in operation, the surplus over the cost of the raw coal (11s. per ton) is 57 per cent. Whether this presents margin enough to pay for the installation cannot be conclusively judged from the paper, as owing to the plant having been built up over a number of years by a process of "trial and error," no useful figures could be given. The fact, however, that the installation is to be extended appears to indicate that the commercial results are comparable with those obtained from the firing of raw coal. If they are no worse, with due allowance made for variations in the market value of the tar products, wider considerations would justify the adoption of low-temperature carbonisation. The authors postulate the necessity, if the best results are to be obtained, for continuous working at high load factor, a condition which obtains on the North-East Coast, and which will become general throughout the country when large generating stations carry the base load.

The B.E.A.M.A. Dinner and Monograph.

The British Electrical and Allied Manufacturers' Association is to be congratulated upon the way in which it always gets together a distinguished company at its dinners. This year nearly everybody of note in the industry seemed to be present, while no fewer than five members of the Government were also there. Lord Derby was, as usual, full of glowing good humour, and there was pleasant raillery between him and Mr. J. H. Thomas.

The latter, not for the first time, stressed the fact that while work could be provided by the expenditure of money, mere spending was not the solution of our difficulties. Only schemes which were economically sound could provide that solution, and particularly any schemes for improving the export trade by which we lived.

Sir Felix Pole, whose obvious grasp of the electrical situation discounted his rather excessive modesty, drew an apt parallel between the electrical manufacturing industry and the railways to justify the difference between home and export prices, or ordinary and excursion fares. Later, Mr. V. Watlington also turned to the railways for an analogy. He said that although the railway companies protested against several electrical manufacturers tendering the same price for similar articles, they rigidly adhered to "price maintenance" themselves.

Lord Derby showed how his opinion of the present Government as individuals altered when he considered them collectively. He revealed his acquaintance with a Labour periodical which Mr. H. Morrison considered a first step towards a change of political allegiance.

The Minister of Transport's speech might appropriately have been delivered at an E.D.A. campaign meeting. He showed a thorough knowledge of the advantages of electricity arising from an intimate acquaintance with electricity in his own home. He urged electricity supply undertakings not to be content with high prices and quick profits, but to abandon the "safety first" attitude and take a little risk with the practical certainty of ample reward.

The atmosphere was an optimistic one, and there seemed to be a genuine desire on the part of the Government representatives to co-operate with, and assist, the industry to go further still upon the road of prosperity.

Another B.E.A.M.A. matter of some importance is the publication this week of a comprehensive survey of the British electrical industry and its relations with other industries and with other countries.

A vast amount of matter has been digested and correlated in producing this monograph and it should prove of great service to all students of the economics of the industry as well as to electrical manufacturers and electricity suppliers. The first instalment of a review of the publication appears in this issue and we hope to complete it next week.

Domestic Electricity Supply in France.

The endeavours to popularise the consumption of electricity for the purpose of domestic cooking are, of course, not confined to our own country. At the present moment the question is attracting a considerable amount of attention across the channel, and in the recent issues of *l'Industrie Electrique* a discussion on the relative economic values of electricity and gas in the kitchen has occupied a good deal of space. The question appears to have been opened by a correspondent who asked naïvely what was the electrical engineer's opinion of the relative costs, taking all the factors into consideration. This question provoked a long article on August 10th by Monsieur Hayet, consulting engineer, in which, after having produced several complicated tables and curves, he arrived regretfully at the conclusion that in Paris electricity for cooking purposes was, last June, 50 per cent. dearer than gas In arriving at this conclusion he takes a cubic metre (35.3 cu. ft.) of gas as being equal to 2.5 kWh, the respective prices being 95 centimes (1.8d.) for the gas (including all delivery charges, meter rent, &c.), and 50 centimes (0.9d.) per kWh for the electricity. The last figure has recently been contested by a correspondent who argues that 44 centimes is sufficient, taking into consideration the hours of the day when cooking is carried out in Parisian homes, as in Paris there are three tariffs for the current—night, day, and peak. He claims that the current is thus reduced in price to 15 or 16 per cent. more than for the corresponding amount of heat provided by gas. The original contributor maintains the 50 per cent., particularly as the results of several previous investigations have given the difference as varying from 0 to 100 per cent. For our own part it would appear that the prices in Paris appear to be low as compared with other large towns in France; in Bordeaux, for example, the price of gas is 81 centimes for domestic purposes and 71 centimes for industry, while for electricity the prices are 125 centimes per kWh for lighting and 75 centimes for power. Whether in Paris the difference in relative costs is 16 per cent., or even 50 per cent., electricity would appear to be favourably situated. However, apart from the relative costs, one of the main obstacles to the wide adoption of current for domestic purposes is the large number of badly constructed appliances to be found on the French market, which, although perhaps low in first cost, are unsatisfactory and disappointing in the end. Electrically heated irons have been in use in France for many years, and their use is increasing rapidly, because their construction is simple, efficient, and inexpensive. If the above figures can be maintained in practice in regard to cooking utensils, constructed as efficiently as the irons, electrical authorities should experience little difficulty in inducing consumers to adopt them in place of gas, particularly in view of the fact that the relative cost of consumption is only one factor in the comparison, others of equal importance being the cleanliness, the absence of fumes, and leaks of gas, as well as the general convenience afforded by electrical appliances, all of which are of value from an economic point of view.

Expert Witnesses.

These can hardly be described as prosperous days for electrical engineers who can rightly lay claim to the title of expert witness. Once they were very much in demand, because fundamental electrical patent cases and other matters required the special services that they were able to render. Then the electrical

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industry was more or less unsteady on its legs, and the assistance of lawyers, counsel, and experts in most interesting battles before Judges of the High Courts, was required to settle patent disputes which prevented a steady forward movement being made. The lawyers, the counsel, and the expert witnesses between them drew large sums from the electrical manufacturers and other claimants to patent and other rights. In those days such litigants had no difficulty in finding expert witnesses of the first water, and who shall say that they did not earn their fees whatever they amounted to? The two parties would vie with each other in securing as early as possible the best counsel and the most distinguished technical authorities available who could be depended upon to make an effective and impressive stand before the most searching counsel or the most learned judge. If editors were called upon to assist litigants with the names of either counsel or witnesses they had little difficulty in finding them. We are not sure that their task would be quite so easy now, as professions may fail for want of practice. To-day we seem to have found a way of settling most of our difficulties without having recourse to the Courts, but we have no doubt that a number of brilliant expert witnesses would soon emerge from their embryonic stage or their seclusion were occasion for their activities to recur. We do not speak without experience when we say that when trade papers in the exercise of their duty make use of experts to assist them in the justification of their criticism, such witnesses charge substantial fees varying according to their standing, qualifications, and general usefulness to the side engaging them. But in our opinion, in such matters as this, if you want the best you must be prepared to pay for it. A County Court Judge has lately laid it down that if you desire to compel an expert witness to appear for you, you have only to serve him with a subpœna accompanied with a sum for travelling expenses, and he must appear. If he fails to do so because a special fee is not forthcoming, he makes himself liable to a fine and imprisonment for contempt of Court. This may be the law but, we, thinking of the electrical cases of the past and of others that may be yet to come, are inclined to be facetious as we contemplate electrical and other scientists, engineers, and industrial magnates, forced against their will into the witness box to swear. In short, whatever the law may say, of what use to anybody is the underpaid and reluctant expert witness? May it not even happen that he who involuntarily came to bless may remain to curse?—unintentionally, of course, despite the low position held by expert witnesses in the celebrated triple classification—liars—damned liars—and expert witnesses!

The Point Five Domestic Rate.

Our contention that the "Table of Domestic Tariffs" which we published as a special supplement to our issue of November 15th would be of interest to electricity supply authorities, has, to judge by the complimentary letters we have received and also by the requests from authorities, national and local, for copies of the inset, proved correct, and we are satisfied that the table has fulfilled a want. Our mails have also shown, as we expected and suggested, that the list was incomplete, and to-day, in our "Electricity for the Home" section, we publish particulars of a few additional "point fivers" to whom our attention has been drawn.

In one respect the "overdraft" table outshines the main "point five" list already published; it contains the particulars of what, from one viewpoint, may be described as the two most important undertakings in the total list. We refer to Hamilton and to Sale, two small undertakings with maximum demands of a little over 1,000 kW, respectively. The next undertaking in size in the list is Beckenham, with a maximum demand of 3,124 kW, which makes Sale's and Hamilton's particularly creditable achievements.

The old assertion, that what can be done by the small undertaking can be done by the large one, is not always just, but we have yet to learn why it is not so in these cases. Sale takes a bulk supply, and, of course, credit is due to the bulk suppliers for the low tariffs at which they must supply, but distribution costs are very heavy nowa-days, and the point five tariffs at both the small towns in question can only be the result of good management.

A correspondent in this issue suggests that the quotation from our editorial columns of November 1st, 1912, in our November 15th issue, is scarcely fair to those who adopt the 0.5 tariff. But our only wish is to commend the 0.5 tariff man on his courage which, it is implied, will reward him in less risks and greater stakes than are, in the first place, apparent.

The effects of the introduction of very low tariffs are cumulative and cannot be forecasted with greater accuracy than a forecast of the state of the electrical industry generally.

The Swiss Federal Railways.

The administration authorities of the Swiss Federal Railways having requested Mr. E. Huber-Stockar to draw up a report respecting the running cost of the Federal railways, the latter has placed before his committee some interesting figures.

Mr. Huber-Stockar has made a comparison between the expenses of the present electric traction and those of steam-traction in previous years, or on sections not as yet electrified. The results of his researches would seem to indicate that the saving already realised in 1929 by the use of electricity amounts to round about five million (Swiss) francs. He goes on to point out that if the price of coal were to fall 20 per cent., or if the rate of interest on the capital for electrification were to be raised to 6.38 per cent., the above-mentioned profit would be practically wiped out; but (and in this respect electricity scores) neither contingency is probable. The price of coal remains stationary, so far as Switzerland is concerned, or is on the rise, while the conversion on electrification loans, which is to take place during the coming years, will reduce to a very large extent the present rate of interest, which is actually 5.48 per cent. Should the rate of interest fall to even 5 per cent., the difference in favour of electric traction would no longer be five million francs, but 7,700,000 francs.

Another factor that is tending to encourage the promoters of the electrification programme is the fact that, in spite of the ever-increasing numbers of motor-cars and private vehicles in Switzerland, more tourists have used Swiss railways this year than ever before, and admiration of their speed, comfort, and cleanliness has been general.

The "Electrical Review" on the Bookstalls.

We have arranged that, commencing with our issue of December 6th, the Electrical Review shall be on sale at the bookstalls of Messrs. W. H. Smith and Sons at the following railway stations:—

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We hope that these additional facilities will meet the convenience of readers who desire to secure their copies of the Review promptly while travelling.

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The Works of Veritys, Ltd.

The business of Messrs. Veritys was originated in 1820, its products including optical apparatus and later oil lamps; to-day the company is in the forefront of the electrical industry as a manufacturer of electrical appliances and fittings for industrial and domestic service.

VERITYS, LTD., is probably one of the oldest electrical manufacturing concerns in this country. It was founded in the year 1820, by Benjamin Verity, an optician and barometer maker, and a great grandfather of George Verity, the present chairman of the company. The business gradually developed into the lighting trade, in those days by candles and oil, and was further extended when gas was introduced. Veritys later entered the electric light business, at the time when the first electric lamp was brought to the notice of an astonished world; this departure culminated in the great electrical exhibition at the Crystal Palace in 1882, when George Verity, a grandson, exhibited a huge floral fitting for which he coined the word "Electrolier." This was the beginning of a large business in ornamental electric fittings, &c., which, in turn, developed into a big trade for installing private plant in clubs, country houses, and so on.

We have found much interest in perusing the original copy of an indenture drawn up in respect of an apprentice to Benjamin Verity in 1836. This bears examples of the curious wording of such old-time documents.

General electrical appliances followed, and this trade was carried on right up to the commencement of the Great War in 1914. During the war the works were practically taken over for Admiralty and marine service, and since then Veritys, Ltd., have specialised entirely on their own manufactures, which include a.c. and d.c. motors, dynamos, control gear, electric fans, and industrial fittings.

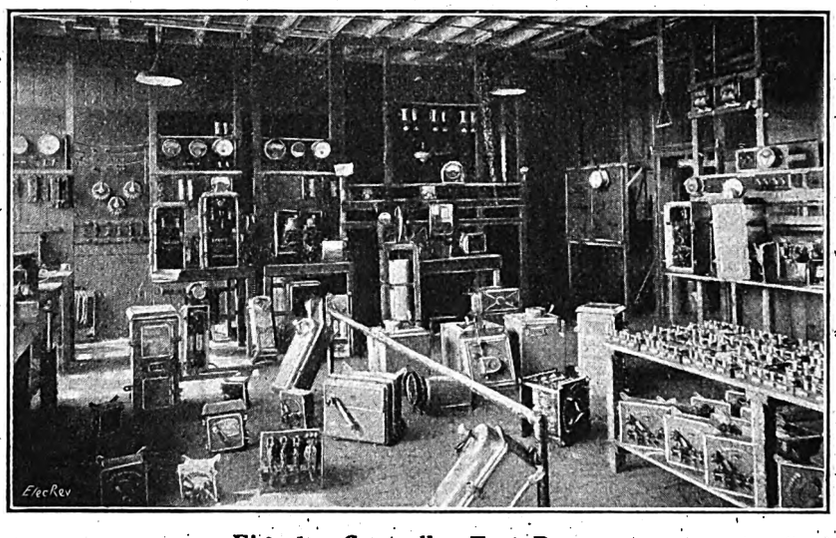

Fig. 1.—Controller Test Room.

During a recent tour of the extensive works at Aston, Birmingham, we were impressed by a large open side planer at work. This machine, fig. 4, has a 15-ft. stroke and is capable of dealing with large jobs quickly and accurately. In the same shop a battery of low-swing lathes was seen at work making dynamo and motor spindles. After leaving these machines all the shafts are pressed on to the grinding machines, where they are accurately ground to size. A special feature in the machine shop is the very large battery of automatics which deal with motor and dynamo brackets and yokes of smaller machines. This battery, fig. 7, is capable of turning out an enormous amount of work, and for some months past has been kept running continuously night and day. The shop is equipped on the most modern lines for speedy and accurate production, and the very latest tools are employed in the various other processes. Fig. 14 is a close-up view of a large automatic machine. This machine is capable of turning out end brackets for up to 40-h.p. motors at the rate of 50 per day.

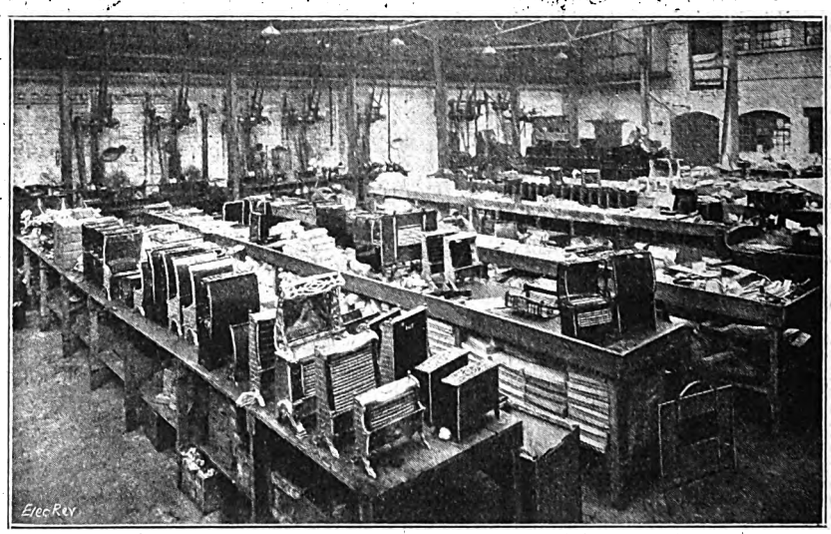

Fig. 2.—The Radiator Shop.

A visit was next paid to the core

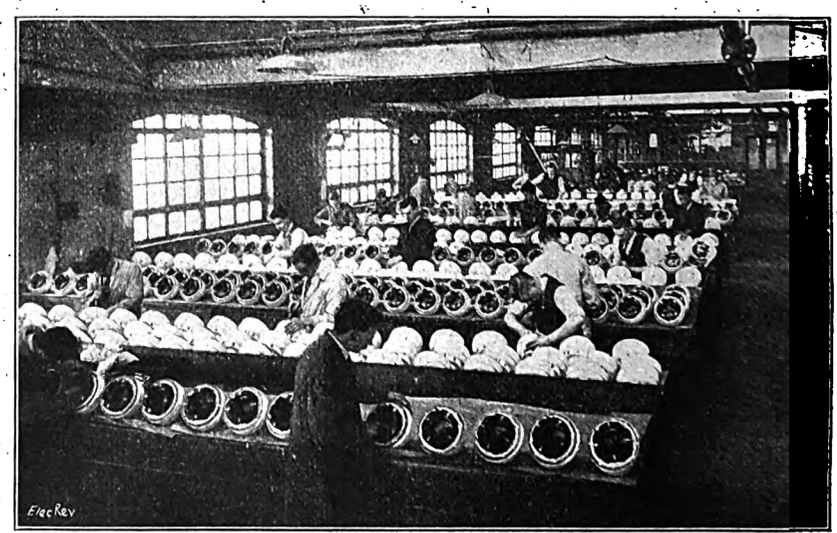

Fig. 3.—Ceiling Fans being Assembled.

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and commutator building department, where the construction of these parts was watched; these range from the smallest to the largest size. In the winding department a large number of men, women, and girls are employed in winding a most varied class of work. All rotors and armatures are dynamically balanced, and very delicate machines are engaged on this work. A view of one of the balancing machines is given in fig. 15. Fig. 8 is an interesting picture taken in the winding shop, showing, during winding, the stators of three 200-h.p. induction motors. Two large impregnating plants are kept busy treating the windings, which are first stoved at 200 deg. F. for 24 hours to remove all moisture, and then they are placed in vacuum tanks, and whilst under vacuum insulating varnish is allowed to flow in, completely submerging the contents of the tanks, thus ensuring that the varnish gets to the innermost parts of the windings. After this treatment they are again taken to the drying stoves and baked at a temperature of 200 deg. F. for 24 hours or more, according to the size of the armature or rotor.

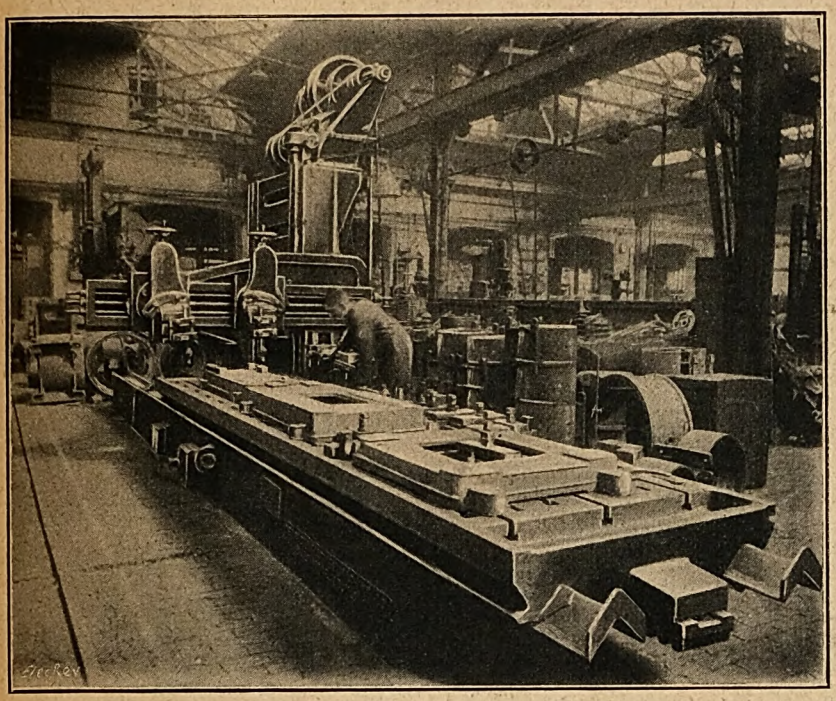

Fig. 4.—Open Side Planer; 15-ft. Stroke.

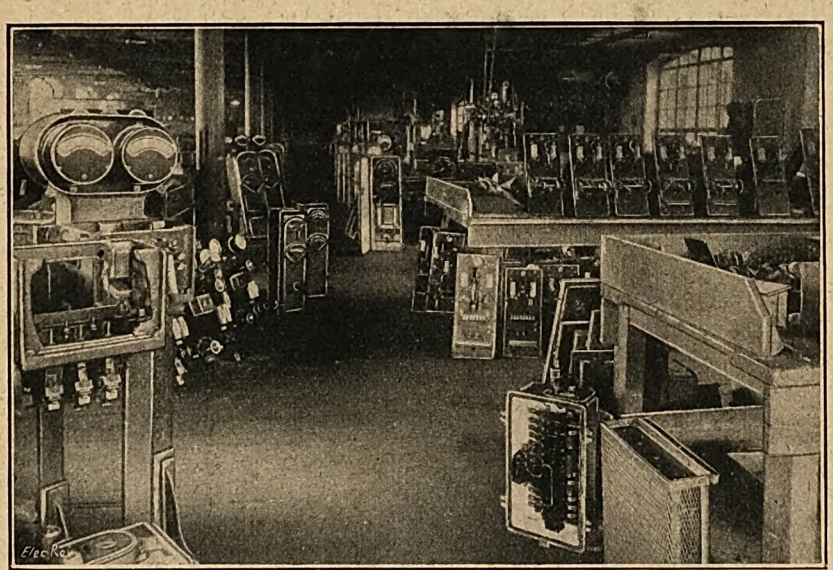

Fig. 5.—Controller Assembly Shop.

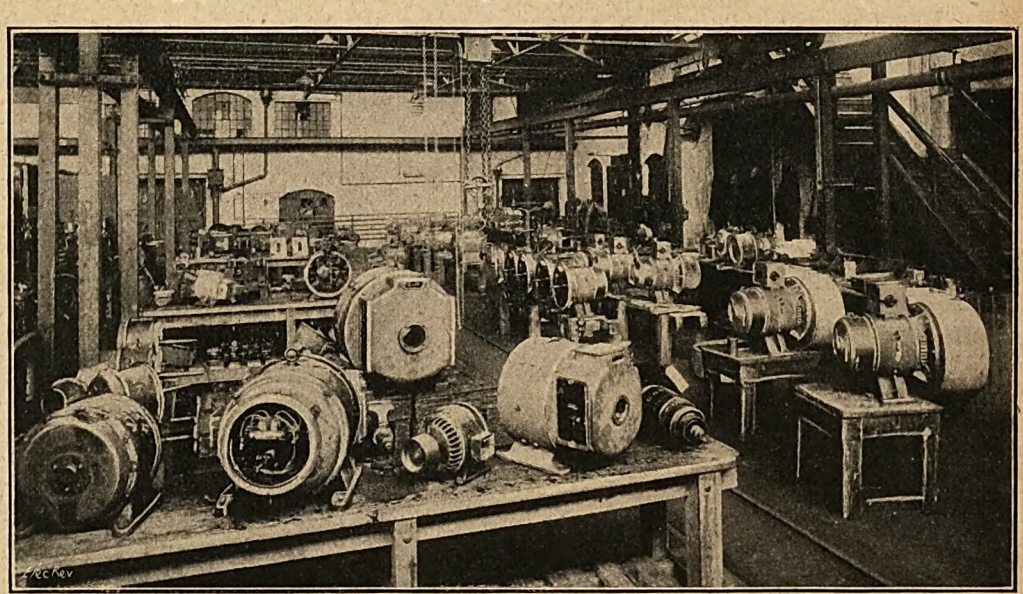

Fig. 6.—Motor-Assembly Shop.

We next visited the completely equipped motor test room. One section of this is devoted to a.c. machines, and one section to d.c. A batch of 12½-in. motor-driven blowers, fig. 9, for the British Admiralty was seen on test, and also a large range of many other types of machines. All the motors and dynamos produced are given six hours' run on full load, then 25 per cent. overload for half-an-hour, and finally 100 per cent. overload momentarily. After test they are flashed, when hot, at double the working voltage plus 1,000 volts, in accordance with the tests laid down by the British Engineering Standards Association. It is possible in this test room to deal with up to 50 or 60 machines on load at one time. Adjoining the test bed is the small motor-assembly shop, fig. 6. This shop has recently been modernised and every facility for quick and clean assembling of ball-bearing machines has been provided.

One of the most particular branches of the company's business is that dealing with the manufacture of fans, which is on a very large scale. A very complete range of fans is made, suitable for ordinary commercial use and also for use on ships and in the tropics. The range practically covers the smallest type of desk fan to the large ceiling fans with blades of 56-in. and 60-in. sweep. Fig. 3 shows a batch of ceiling fans being assembled. It was interesting to note the hundreds of the company's well-known "Orbit" fans being tested, a large number of which were for the British Admiralty, and the operation of so many of these fans all together is a somewhat curious sight. Special attention is being given by Veritys at present to

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the design of what are known as "high efficiency" fans. The machine shop of the controller department is equipped with all the necessary up-to-date machinery and tools for the mass production of competent parts of switch and control gear. The main section of the controller shop, fig. 5, is devoted to the assembly of innumerable types of control apparatus for a.c. and d.c. motors and generators of medium and large capacity. The control apparatus produced comprises main switchboards of the open type and ironclad unit types, ironclad distribution boards, face-plate starters, complete starting panels, face-plate and drum type, circuit breakers, contactors, automatic solenoid starters, crane controllers and panels, shunt and series regulators, and oil-immersed switches and starters, both in separate units and in panel form. The company also specialises in robust control gear for marine use. Many unique features are incorporated in the apparatus to ensure correct and foolproof operation, and special mention may be made of the d.c. drum panels, with ratchet operation and timing devices to ensure smooth acceleration in starting up, also the rotor and stator starter with special interlocks for correct sequence in starting.

All control apparatus is subject to searching tests before leaving the shops. Tests for temperature, resistance, and also insulation and flash tests are taken, after which a general inspection of the apparatus is carried out. Fig 1 is a view in the controller test room.

An auxiliary section of the controller department is devoted to the assembly of air-break and oil-immersed starters for the control of the smaller motors. To ensure interchangeability, all parts are assembled in special jigs. The V.H.C. starter, fig. 13, is used in connection with the high-torque Verity-Heemaf motor for limiting the current rush on any notch of the controller to a figure which is considerably below full-load current. Reference to the diagram, fig. 11, will give an idea of the characteristic of a 40-b.h.p. V.H. motor when used with this type of starter. It will be seen that the opposing torque at starting is 50 per cent. of full-load torque. The controller has five positions or notches, as well as the "off" position. On the first notch the current rush is approximately 50 per cent.; on the second 40 per cent.; and on the third 70 per cent.; thus giving a total of 160 per cent. of full-load current, but in three distinct stages. With the controller in this position, *i.e.*, on the third notch, and not until then, the motor starts with a torque of approximately 80 per cent. of full-load torque.

Owing to the great accelerating torque, as compared with the opposing torque, *i.e.*, 80 per cent. against 50 per cent., the motor will now quickly speed up until the opposing torque and developed torque are equal at approximately 83 per cent. of full-load speed, when the motor ceases to accelerate; the current in the meantime has decreased from 160 per cent. to approximately 90 per cent. After switching on to the fourth notch the current increases from 90 per cent. to approximately 175 per cent. (or a rush of 85 per cent. f.l.c.).

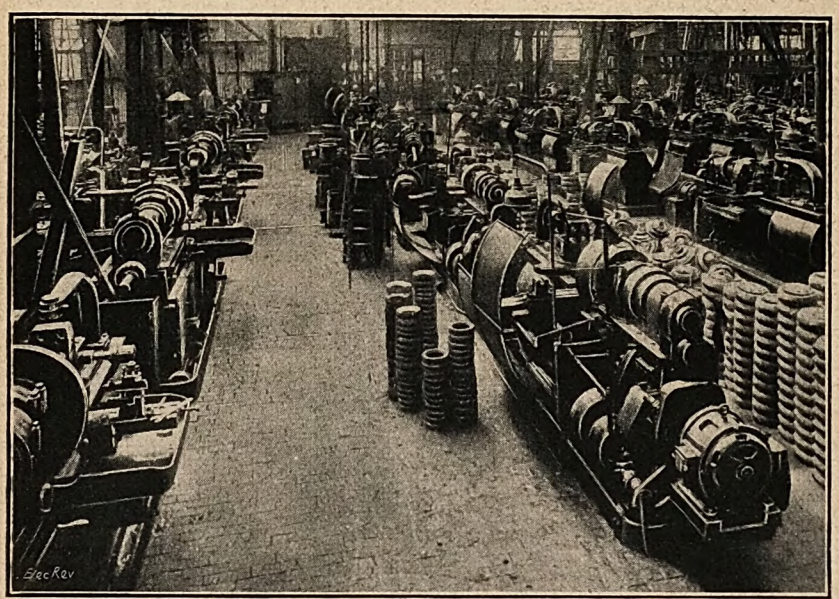

Fig. 7.—A Battery of Automatic Machines.

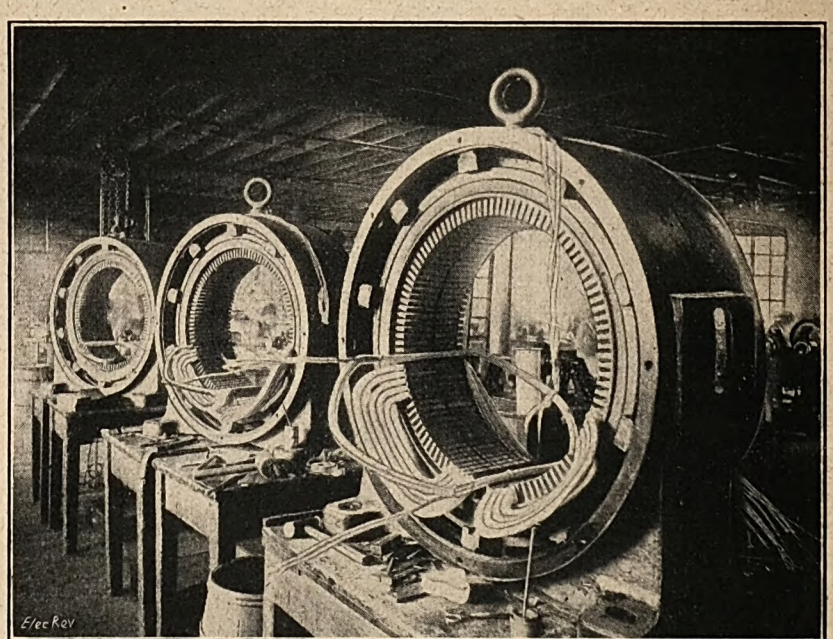

Fig. 8.—Large Stators in Winding Shop.

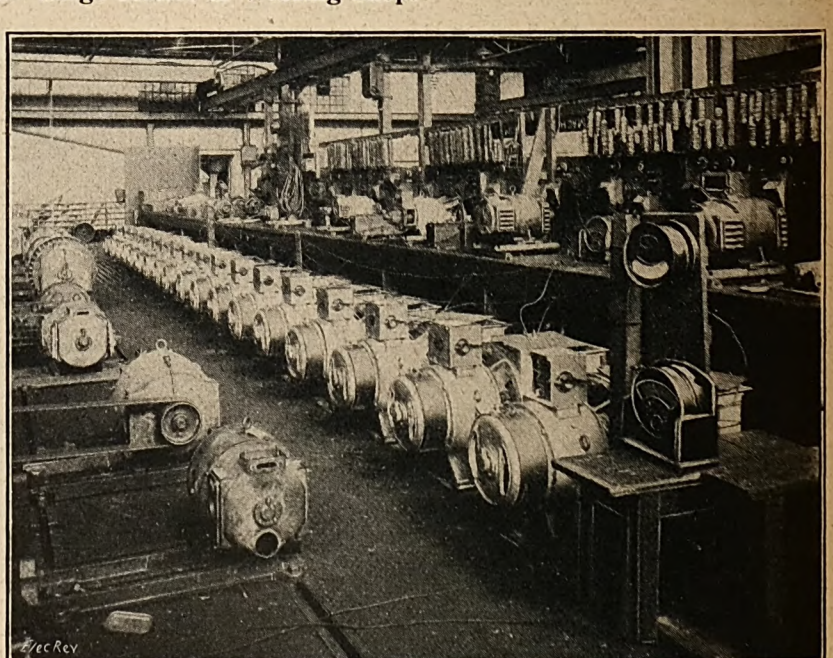

Fig. 9.—Blower Motors under Test.

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and the corresponding torque to about 95 per cent. f.l.t. The motor further accelerates until the motor and opposing torques are again equal. Now and finally when switched on to the fifth notch the current reaches the peak of just over 200 per cent. of f.l.c. The accelerating torque is more than twice as high as the opposing torque, and the motor rapidly attains full speed. The current peak on the final notch quickly falls to normal full-load current. It will be seen that no rush of current on any notch reaches anythink like f.l.c., consequently the V.H. motor, when

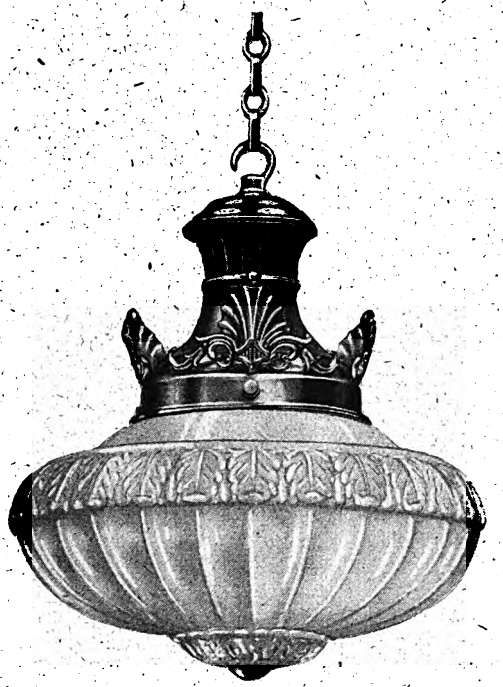

Fig. 10.—Commercial Fitting with Under-Lip Gallery.

used in conjunction with the V.H.C. controller, complies in every way with supply companies' requirements with regard to current rushes.

A visit was also paid to a separate factory which deals with press work in connection with the company's manu-

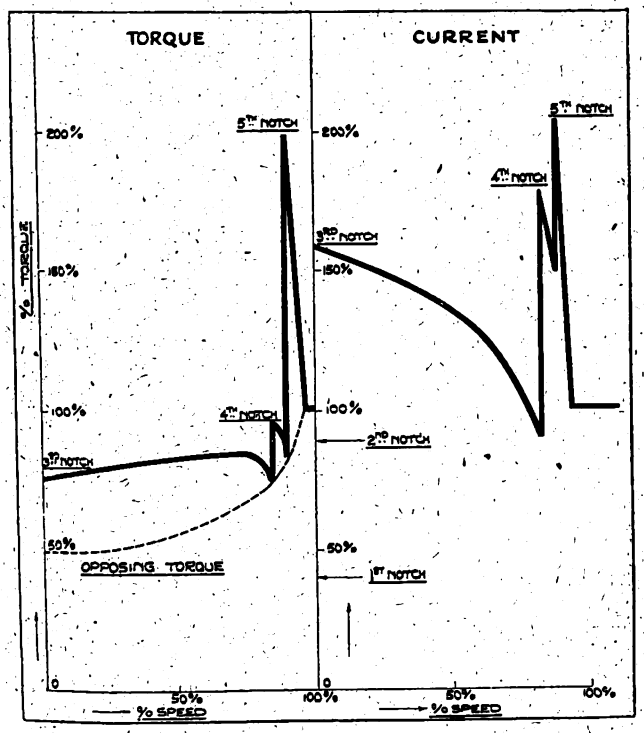

Fig. 11.—Characteristic of 40-h.p. V.H. Motor, with V.H.C. Starter.

factures. A large number of hand and power presses are used. The company employs laminated poles for all its d.c. machines; combination tools are used for stamping out a.c. and d.c. armatures, rotor and stator disks, thus ensuring very accurate slots.

This factory also deals with the manufacture of all small parts, such as screws and the numerous hundred-and-one parts which are used in the manufacture of such a large range of electrical apparatus.

The "Maxlume" section of the works is devoted entirely to the manufacture of industrial reflectors,

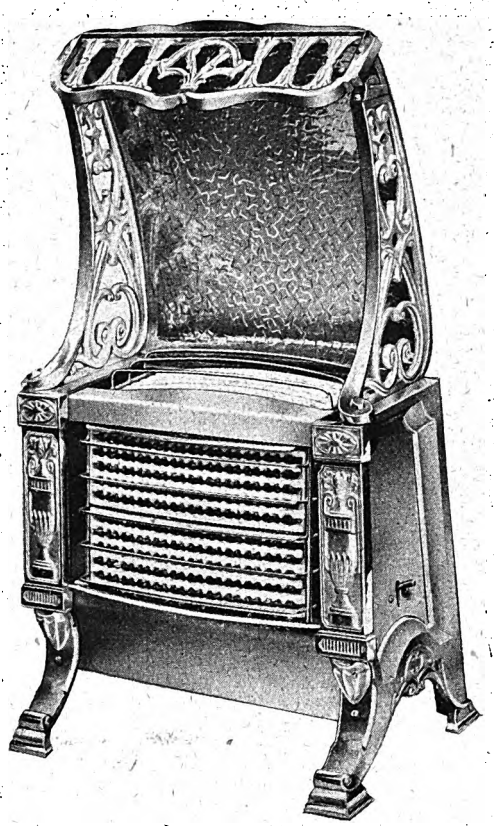

Fig. 12.—The "Compton" Fire.

street-lighting, ship, train, and general commercial lighting equipment and electric radiators. A large shop, fig. 2, is engaged in making radiators, and a special feature of interest is that they are built up of aluminium-alloy. This has several advantages over cast-iron on account of weight. Many of the better-class fires, which

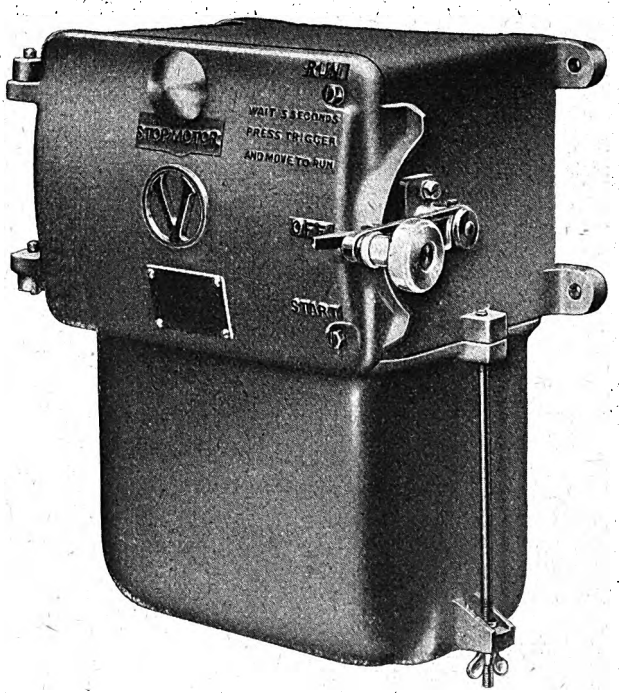

Fig. 13.—V.H.C. Motor Starter.

are designed large enough to conceal the ordinary fireplace, if made in iron, can hardly be lifted; if made in aluminium they immediately become portable.

Fig. 12 shows the 3-bar "Compton" fire. It has a loading of 3,000 watts, and two switches provide 3 deg.

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of heat. It is a handsome apparatus, designed with Jacobean enrichments, for portable use, and large enough to conceal the usual fireplace opening. It stands high on the hearth, is strong, but very light, in contrast to the usual heavy cast-iron fires. The highly polished copper reflector throws forward the heat from the top

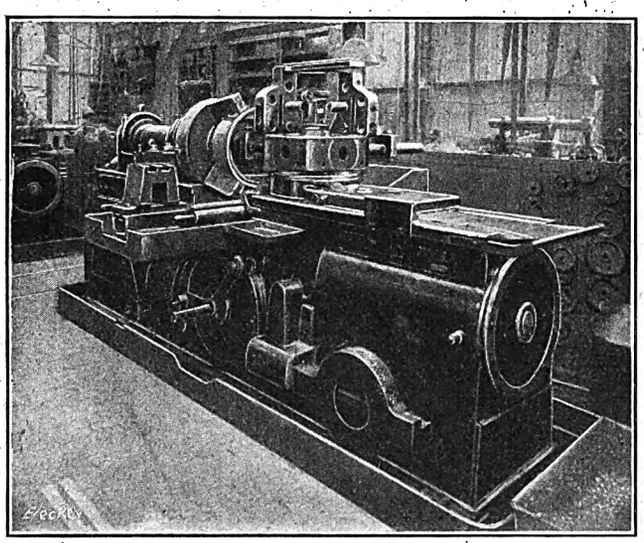
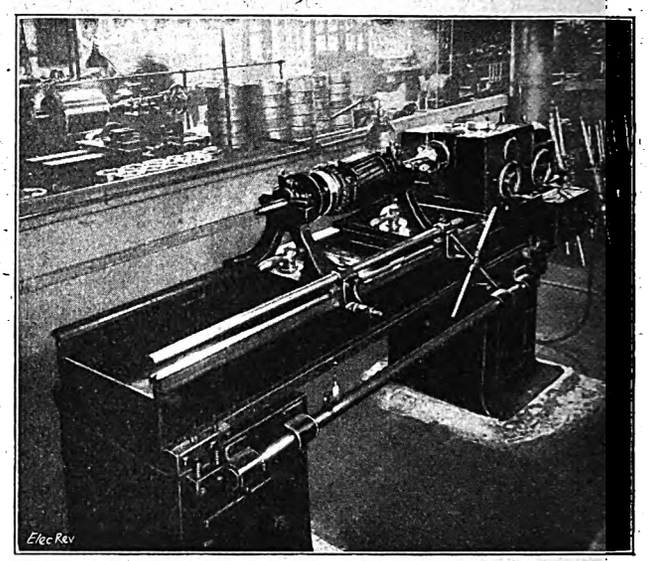


Fig. 14.—Large Automatic Machine.

heating bar most efficiently, and the effect of the glow in the reflector is very attractive.

A very interesting lighting fitting just marketed by the company is the new patent under-lip gallery, designed for the support of heavy and large glass fittings to take large wattage lamps. It will be noticed from the illustration, fig. 10, that the glass is held underneath the lip instead of in the groove; this ensures a safety grip for the heavy glass and has met with much success. "Maxlume" industrial reflectors are designed to meet



Fg. 15.—Dynamic Balancing Machine.

almost any factory lighting conditions. The Home Office type, having 20 deg. cut-off to avoid glare, the recommendation of the Home Office Committee, was one of the first reflectors embodying this feature to be marketed.

An Auto-Condenser.

A compact arrangement that is capable of affording a large number of combinations and, at the same time, effecting a considerable saving of material.

By A. MORTIMER CODD, F.Ph.S.

WHEN using auto-transformers the author has frequently wondered whether it would be possible to effect the same facility in tapping with its complementary apparatus the condenser, by inserting here and there one or more additional foils.

At first the idea seemed fantastic, but a few experiments soon showed that it worked perfectly in practice and was susceptible to simple theoretical laws in explanation. Fig. 1 depicts an ordinary simple condenser, the small diagrams above showing the theoretical con-

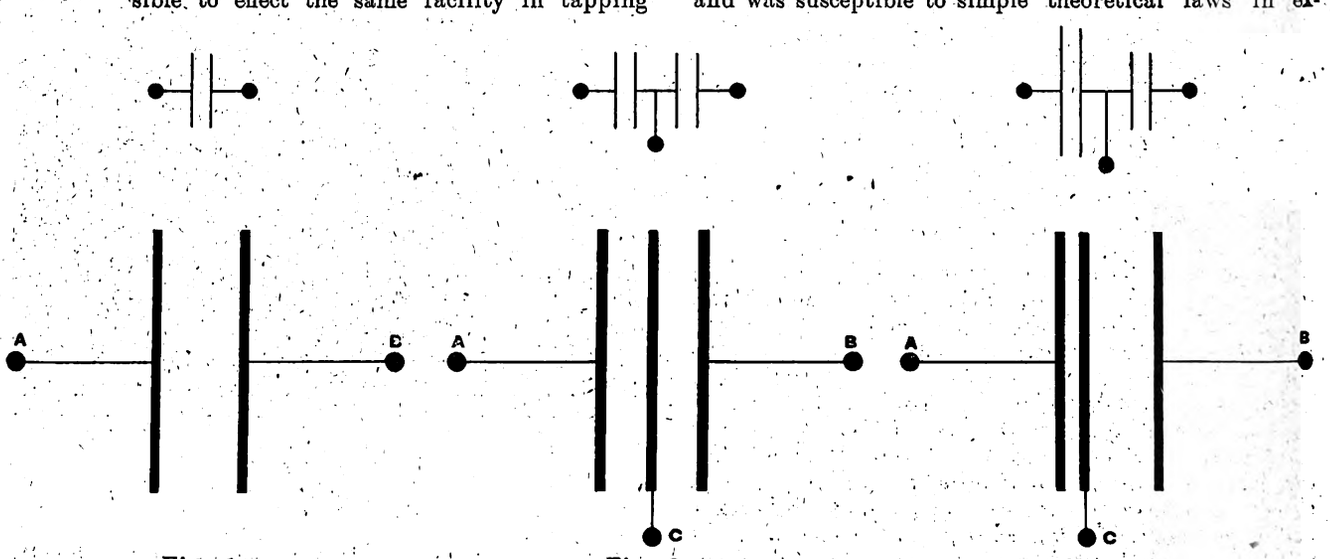


Fig. 1. Fig. 2. Fig. 4.

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ditions within. There are two plates, armatures, or foils, separated by a dielectric, which may be a gas (such as air), a solid (such as mica, paper, or glass), or a liquid (such as oil, or liquid of the electrolytic variety). The constitution of the dielectric does not affect the con-

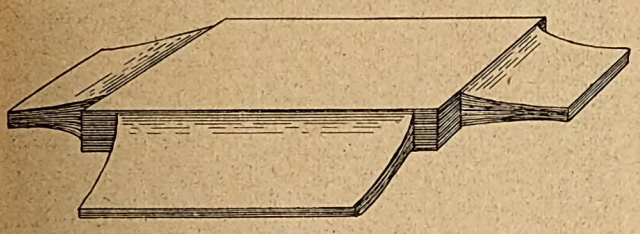


Fig. 3.

siderations under review. It is sufficient to remember that if an alternating pressure be applied to the two main plates A and B a current will flow in and out of those plates, straining the dielectric between them.

Suppose now that a third plate C is made to slide in between A and B centrally as indicated in fig. 2, virtually forming two condensers in series. For clearness it is proposed to call the additional plate, or plates, "interplates." The general arrangement of such an auto-condenser, of paper and foil, is sketched in fig. 3, in which A and B are the main plates and C is the interplate. If a pressure is now applied between A and B, it is possible to tap off from AC or BC a pressure equal to half the main voltage; that is, the pressure between AC is equal to that from CB, because the disposition of the plates with respect to the dielectric is symmetrical. It is possible that, if the terminals A, B and C were connected to a 3-phase circuit, interesting oscillographic records would be obtained.

Now let us further suppose that we move plate C away from the centre, so that it is, say, one-third distant from A and two-thirds distant from B, as indicated in fig. 4. By decentralising the interplate we can bias the dielectric, so that pressures proportional to the thickness of the dielectric will be given off. Thus, if 100 volts is applied between A and B, the pressure between AC will be 33 volts and that between CB 66 volts. Further, if a current of one ampere is surging between A and B, a current of nearly one ampere can be drawn between C and B, proportionally less being given from A and C. It will be realised that, although any current and voltage can be drawn off from the auto-condenser, the current and voltage cannot exceed those of the main circuit; in other words, the device does not in this respect behave as an auto-transformer by stepping up. Further, the current pulsating between A and B is limited by the capacity of the smallest condenser (if any) of the series.

It will be noticed that in the preceding examples (figs. 2 and 4), although we can tap off a voltage either from C to A, or from C to B, we may not be able to use both tappings without risk of partially short circuiting A and B. That risk can, however, be avoided by the use of a second interplate D (fig. 5), but the latter cannot be as large as C, since it would shield it from electrostatic influence; it is, therefore, necessary to effect the design by what amounts to cutting C in half to form both C and D.

We shall now find that the pressures between DA, DB, CA, and CB are all equal, and of half the value of that obtaining between A and B; thus, if the pressure between A and B is as before 100 volts, 50-volt lamps can be connected between AD and CB independently; C and D need not necessarily be equal, but may be any fractions circumstances may dictate. Their area does not affect the pressure, but only the current output, which is proportional to the area.

If now we bias the dielectric for both the interplates,

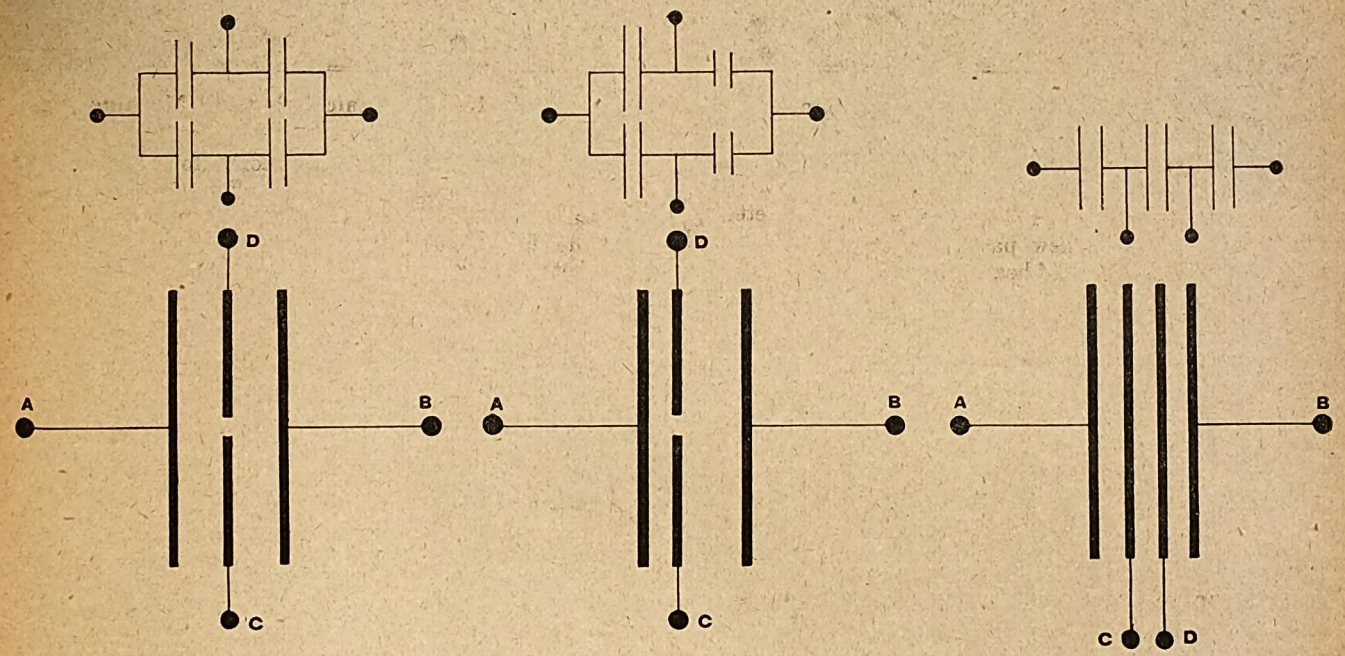
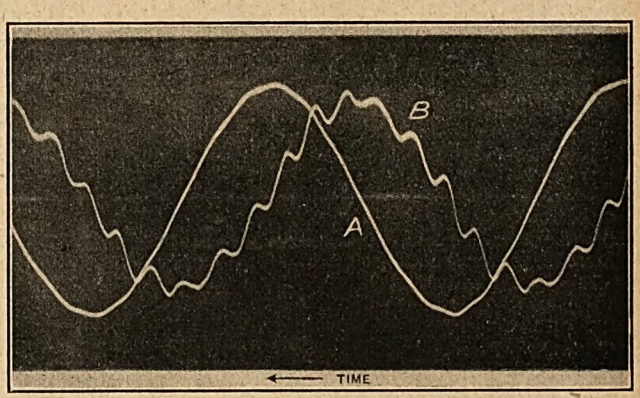


Fig. 5. Fig. 6. Fig. 7.

as we have already done in fig. 4, we carry the disposition of the auto-condenser a step forward, as shown in fig. 6. In this case the pressure between AD and AC will be one-third of that between A and B, while that between BC and BD will be two-thirds. As the interplates



A=voltage; B=current.
No load condition.

Fig. 8.

C and D are free, we can draw pressures of, say, 33 volts from AD and 66 volts from BC, if the voltage of AB is maintained at 100 volts.

Fig. 7 carries the arrangement another step in advance. Instead of using one interplate, two or more

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interplates (CD) can be arranged, the effect of which is to place the interplates as condensers in series.

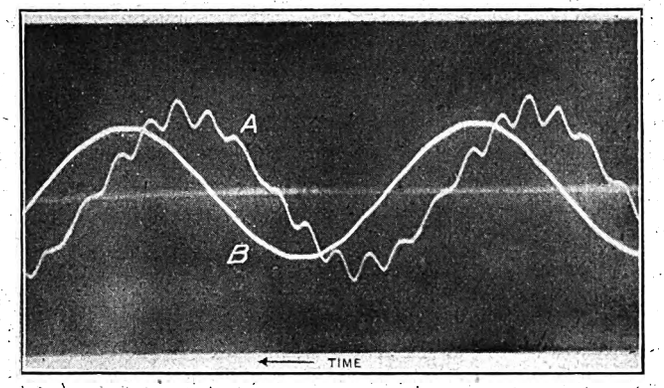
It may be asked wherein is the auto-condenser better than an arrangement of ordinary condensers in series or parallel? The reply is that the auto-condenser is a compact unit able to afford a large number of combinations, if desired, and at the same time effecting a considerable saving in material.

Some, viewing for the first time the unfamiliar arrangement of the auto-condenser, may question how it is possible to draw off current and voltage without apparently increasing the external source of supply. This is, of course, a fallacy.

Turning again to fig. 2, if the capacity between A and B be unity, regarding the arrangement as a simple condenser, then the capacity between C and A, or C and B, will be twice unity and that between C and AB connected four times unity. Now, suppose a current to be flowing in and out of the condenser between A and B, and a load to be applied between, say, C and B. Let the load be increased until C and B are virtually short circuited, then the arrangement becomes a simple condenser with plates A and C, but a condenser of twice the capacity of A and B and, therefore, capable of passing twice the current. That is the reason why in fig. 4 a greater current can be drawn from CB than from AC.

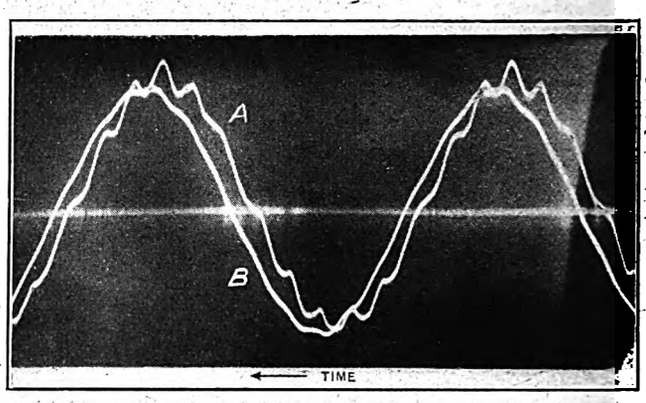
Fig. 8 shows the main current flowing in the condenser and the voltage over the interplate C. It will be noticed that current and voltage are nearly out of phase, the slight difference being due, no doubt, to the current taken by the voltage strip of the oscillograph. Fig. 9 shows the currents both in the main circuit and in the interplate on light load, while fig. 10 shows the same thing with a heavier load in the interplate. It will be noticed that not only is the magnitude of the current loops increased, but that they also appear to be coming more into step.

Various combinations of the auto-condenser indicated could be multiplied to tedious length, but I think the above examples will suffice to illustrate the principle. For example, fig. 2 could be used in a filter, or smoothing circuit, and figs. 5 and 6 to work independently lamps, loud-speakers, or other loads of widely different voltage. The arrangement shown in fig. 7 is convenient for lowering the voltage of a high-pressure circuit, so that the reading of a relatively low-voltage instrument tapped off can be calibrated in high-voltage figures. The area of the interplates can be relatively small if an electrostatic instrument is used, provided the area of the interplates bear some relation to that of the moving vanes. With this arrangement also in a h.f. or diathermic circuit C and D might be the patient terminals. Being earth-free, there would be no danger of the patient being placed in metallic connection with a conductor at high potential. Doubtless many other uses and combinations will occur to the reader in his specialised branch of electrical application.



A=mains current.
B=interplate current.
Light load condition.

Fig. 9.



A=mains current.
B=intermediate current.
Heavier load condition.

Fig. 10.

Automatic Combustion Control.

Some Features of the System Adopted at the Edgar Generating Station, Boston, U.S.A.

By C. H. S. TUPHOLME.

An interesting example of the application of automatic combustion control as applied to high-pressure boilers is to be found at the Edgar generating station, Boston, of the Edison Electric Illuminating Co. The boiler plant in this case comprises three working at 375 lb. and five at 1,300 lb. pressure per sq. in. A complete automatic combustion control equipment has been installed by the Bailey Meter Co. The boilers are fitted with underfeed-stokers, driven by electric motors, the speeds of which are controlled by shifting the brushes as indicated in the diagram. All the boilers are equipped with both forced- and induced-draught fans.

Each of the last four high-pressure boilers, Nos. 5, 6, 7, and 8, has two induced-draught and two forced-draught fans. The two fans in each case are coupled together, with a small motor for low ratings connected to one end of the fan shaft, and a larger motor for high ratings connected to the other end.

On boilers Nos. 5 and 6 the forced-draught fans employ 125-h.p. and 300-h.p. motors for the low and high ratings, respectively, and the induced-draught fans have 200-h.p. and 450-h.p. motors. The control equipment has been designed to operate the fan motor drum controllers and also to throttle the dampers on the inlet side of the fans in order to obtain ratings below those possible with the small fan motors running at the minimum speed. In order to operate the inlet dampers and the two drum controllers in the proper sequence, two pairs of intermittent gears are used as shown in the diagram.

In the case of the forced-draught fans, for instance,

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when the damper is opening from the closed position to approximately 50 deg., both the intermittent pinions driving the drum controllers will be sliding on the intermittent driving gears. At 50 deg. damper opening, the intermittent pinion driving the 31-point controller for the 125-h.p. forced-draught fan motor is picked up and driven to the maximum drum controller position, at which time it again slides. The intermittent pinion on the 29-point drum controller for the 300-h.p. motor is picked up when the controller for the small motor is on its 29th step, and it is gradually advanced from this

The control drives are designed so that the rates of supply of air and fuel are varied in substantially the correct proportion. The slight readjustments necessary in the fuel supply to maintain the correct fuel-air ratio are made automatically by the steam-flow and air-flow contactor, while the air supplied to the fuel bed by forced draught is governed by the furnace draught. In this way all three conditions for proper operation are satisfied.

The control drives used to regulate the induced and forced draught at the Edgar station each contain a pair

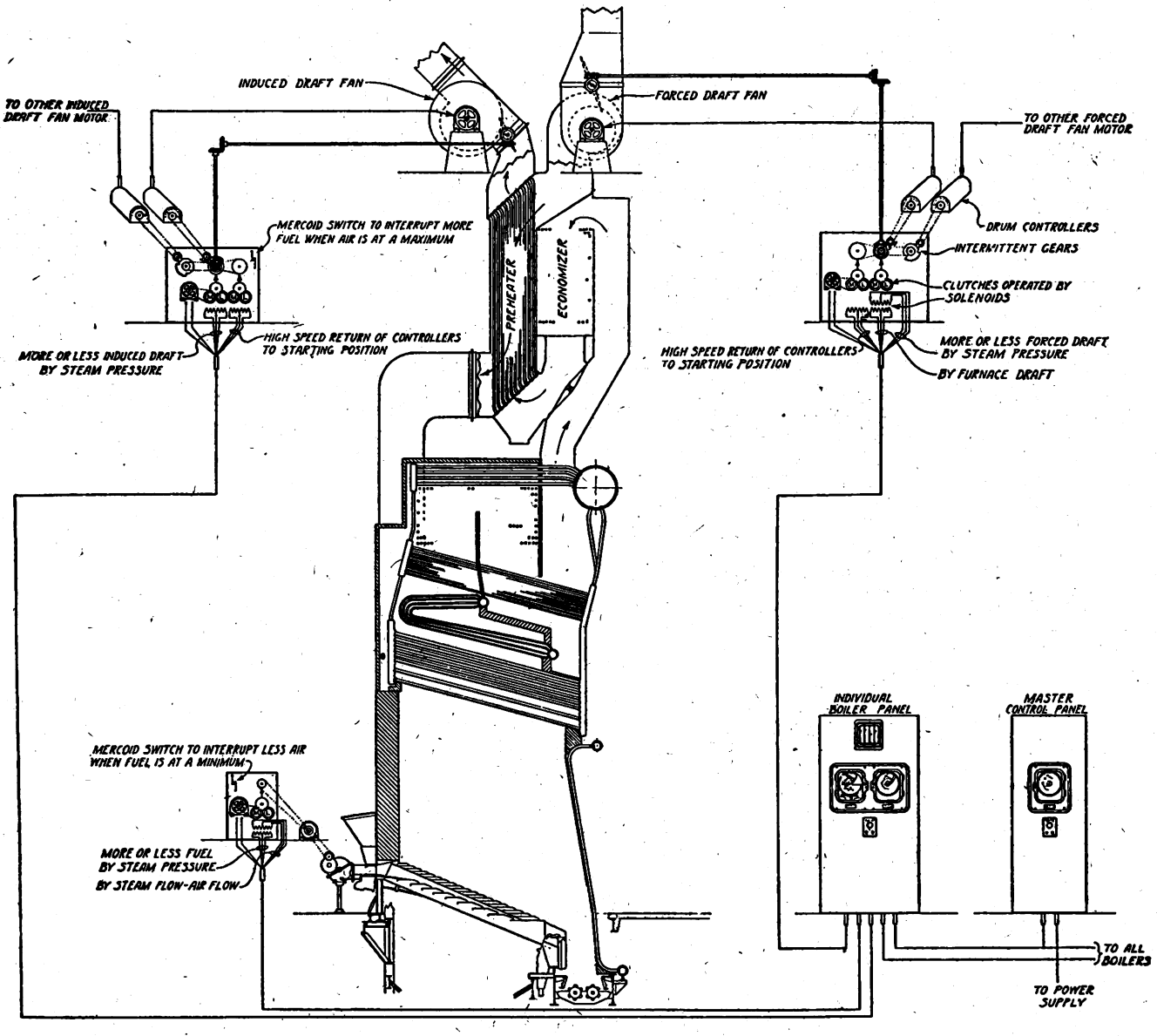

Fig. 1.—Diagram of the Control System of the Boiler-house Plant.

position until the maximum fan speed is obtained and the damper is wide open. The induced draught for boilers Nos. 5 and 6 is controlled in a similar manner.

The second extension at the Edgar station consists of two high-pressure boilers. Nos. 7 and 8, which are similar to Nos. 5 and 6, comprising the first extension, with the exception that they are equipped with Sturtevant fans with inlet vane control, and each pair of the two induced and two forced-draught fans is driven by two single-speed motors. The control of the inlet vanes and the automatic changing of the fan speed is determined by the rating on the boiler.

The Bailey meter control system in this plant changes the supply of fuel and air to all boilers simultaneously in response to changes in the steam pressure. When the load on the station increases the steam pressure starts to drop and the master steam pressure contactor makes contact to increase the speed of the stokers, forced-draught fans, and induced-draught fans on all boilers connected to the control system, distributing the load change equally among the various boilers.

of high-speed clutches to permit of the automatic return of the drum controllers to their starting position after a power failure, and to close quickly or open the inlet vanes on boilers Nos. 7 and 8 when decreasing or increasing the fan speed.

The writer is indebted to the Bailey Meter Co. for the diagram of the connections at the Edgar station reproduced above.

Essay Competition.

The *Journal of Careers* for November contains particulars of a Prize Essay Competition for boys of from 16 to 19 years of age. It is organised in conjunction with the Economic League and offers a first prize of £100, and a number of others for £25 and £5 each for an essay on "What I want to be and why." Entries have to be sent in on a special form by December 21st.

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Our Overseas Electrical Markets.

Economic Conditions in Australia, New Zealand, South Africa and India.

WE give below our usual quarterly survey of economic conditions in Great Britain's best overseas markets for electrical goods, *viz.*, India, Australia, New Zealand, and South Africa, together with charts showing the trend in recent months of imports of such goods into those countries.

Australia.

The outlook in Australia is not too promising, but it need not be assumed that the defeat of Mr. Bruce and

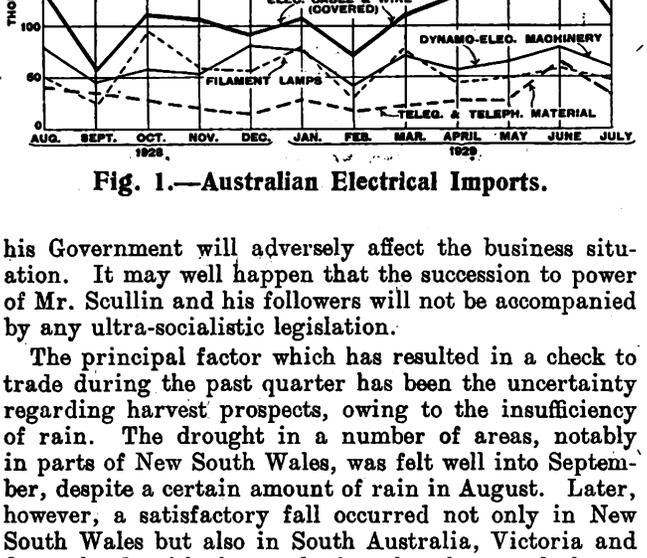

Fig. 1.—Australian Electrical Imports.

his Government will adversely affect the business situation. It may well happen that the succession to power of Mr. Scullin and his followers will not be accompanied by any ultra-socialistic legislation.

The principal factor which has resulted in a check to trade during the past quarter has been the uncertainty regarding harvest prospects, owing to the insufficiency of rain. The drought in a number of areas, notably in parts of New South Wales, was felt well into September, despite a certain amount of rain in August. Later, however, a satisfactory fall occurred not only in New South Wales but also in South Australia, Victoria and Queensland, with the result that the wheat outlook was improved. In Western Australia prospects are expected to compensate to some extent for indifferent crops in other States, but the wheat yield does not seem likely to be above the normal.

While the wool clip is large, disappointment is felt regarding the depression in prices. On the other hand, a large butter and fruit production is confidently expected. The opinion is, however, expressed in banking circles that the adverse seasonal outlook is being partly offset by improved business organisation and general economies.

Another depressing factor has been the disputes in the coal and timber trades. These affected general business adversely, and as a result unemployment increased in many industries while wholesalers and retailers found difficulty in clearing their stocks. The motor vehicle market, particularly commercial cars, grew dull; it is not anticipated that the trade in light passenger cars and trucks will remain quiet for long. There is an impression in banking circles that imports of general merchandise will suffer restriction.

With regard to the electrical trade, whereas the demand for industrial motors and other electrical apparatus of the heavier type continues to be slow, an increasing business in household electrical goods is developing. A large share of the last-named is being obtained by Canadian manufacturers.

For the fiscal year ended June 30th last, there was a small favourable trade balance totalling £1,150,000, comparing with an unfavourable balance of £4,730,000 twelve months before. For the Michaelmas quarter the Customs revenue totalled £11,522,000, being £584,000 above the estimates. During the twelve months ended June last Australia's imports of electrical machinery and appliances totalled £6,132,000 in value as compared with £7,127,900 during the previous twelve months.

On the general economic position of the Commonwealth, Sir Ernest Clark, a member of the British Economic Mission, made some interesting remarks recently. He said that the final conclusion of the Mission was that Australia's creditors had no cause for present anxiety because she was still borrowing well within her actual potential resources; but they were of opinion that she had not, in past years, borrowed wisely, and that she had pledged to too great an extent those future resources, and mortgaged too deeply that future prosperity upon which she could reasonably reckon, thus throwing the burden of her borrowings upon future generations who would have their own needs to meet. He pointed out that one half of Australia's debt was owed to her own people, and she was in the position of being able to pay more than half her debt from her assets.

New Zealand.

During the past quarter business conditions on the whole have shown favourable tendencies. Production has been on a satisfactory level, and although prices of wool have been weak those for meat products have improved.

Seasonal quietude in trade has been rather less pronounced this year than it was twelve months ago. There has recently been an improved demand for motor cars and accessories, builders' hardware and electrical goods.

Fig. 2.—New Zealand's Electrical Imports.

The Government is dealing in a systematic manner with the unemployment problem, which, although not very serious, has been giving rise to some anxiety. Steps are being taken to encourage and expedite land settlement and to organise a public works programme. The Prime Minister takes an optimistic view of the labour situation, and at the end of September declared that a few weeks would see a solution, inasmuch as all the unem-

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ployed would be absorbed. Occupation has been found on forestry operations, road construction and similar work.

Good crops are forecast in most parts of the Dominion as a result of the favourable weather, and the prospects for a good dairy season are considered encouraging.

New Zealand's import figures for September were the highest for seven years.

South Africa.

While few important changes have taken place in South African commercial conditions during the past quarter, there have been signs of slackening business. The engineering trades in Johannesburg and manufacturing industries in Cape Town have been quiet. In boot and shoe making, activity has been rather below normal, which has some significance in a branch which generally reflects the purchasing power of the community as a whole. Business in mining material and machinery has been up to the average.

Thus far during the financial year (*i.e.*, since April 1st) railway earnings have been below both estimates and the figure for the corresponding period of the previous year. With regard to foreign trade, exports from January to September show a decline in value of about £3,000,000, and imports an increase of nearly the same amount. Gold production for the eight months was £400,000 up on the year. The diamond market

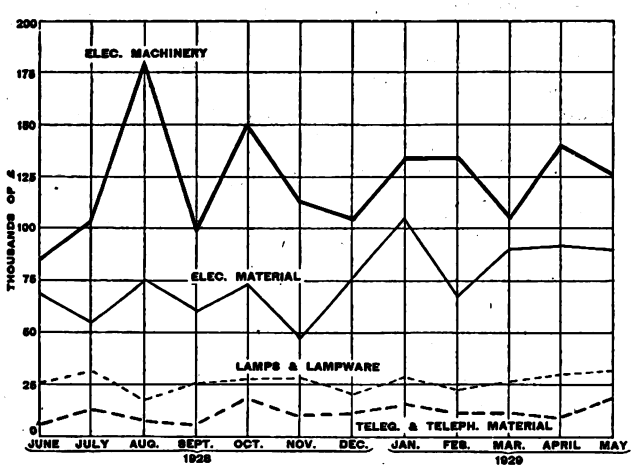

Fig. 3.—South African Electrical Imports.

appears to have been affected by the prospect of a revision in the American duty on precious stones. Coal output has increased in Natal, but decreased in the Transvaal; the changes, however, are only slight.

On the other hand, the agricultural outlook is promising. Rain has been abundant in the Cape Province, and the forecasts for fruit, wheat and oats are excellent. Fruit exports have continued their increase. Grain prices have receded in accordance with the world trend. The decline in wool is expected to be balanced, so far as South Africa is concerned, by an improvement in the quantity and quality of the clip.

There is a feeling that financial conditions are tending towards a restriction before long of purchases of railway and other constructional and engineering material. After five years of practically unbroken prosperity, it would not be surprising if something in the nature of a setback occurred.

India.

It is to be feared that British electrical manufacturers have little reason for encouragement from the announcement of the agreement between Messrs. Tata & Sons, Ltd., and an American syndicate, with respect to the management of the Tata hydro-electric companies.

According to a statement made by a director of the Tata concern, the syndicate in question, which is the American and Foreign Power Co., Inc., will possibly help Bombay's hydro-electric industry by giving it financial assistance. It will probably adjust the finances of the Bombay undertaking, in order to reduce the interest charges. Whether or not the shareholders of the Bombay Electric Supply & Tramways Co., Ltd., would sell their company was, he said, another matter. The Americans may finance fresh schemes of development. On the other hand, it is satisfactory to find that in Madras, orders for rolling stock for the suburban electric services have been placed in Great Britain.

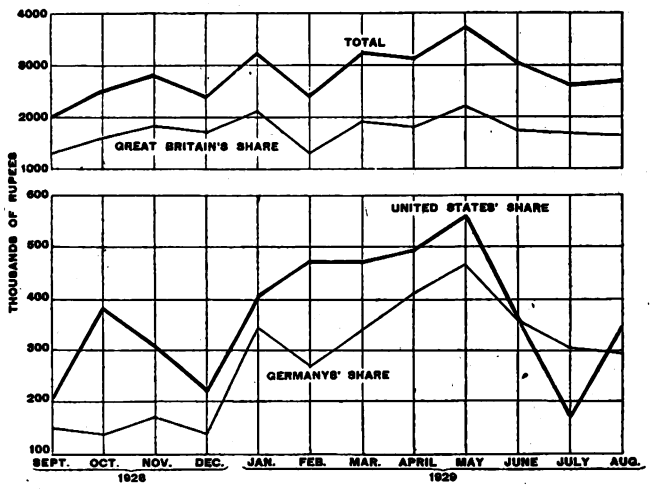

Fig. 4.—Indian Electrical Apparatus Imports.

An interesting account of the progress of the Pykara hydro-electric scheme is contained in the recently issued report for 1928 of the Madras Hydro-Electric Department. The surveys made included the power house site and part of the transmission lines, &c., and detailed designs and estimates were prepared. As a result of recommendations by Messrs. Merz & Partners, additions were made to the proposed installation equipment. Conferences with the consulting electrical engineers to the South Indian Railway (Messrs. Robt. White and Partners) were also held on the subject of the best means of electrifying certain sections of that railway, and work on the Trichinopoly-Madura, Dindigul-Olavakkot-Shoranur-Podanur-Mettupalayan-Erode and Nilgiri Railway was recommended.

It was decided to undertake the construction of the Glen Morgan project, in order that a start could be made on the electrical development of the Nilgiris, and a source of power for construction purposes be made

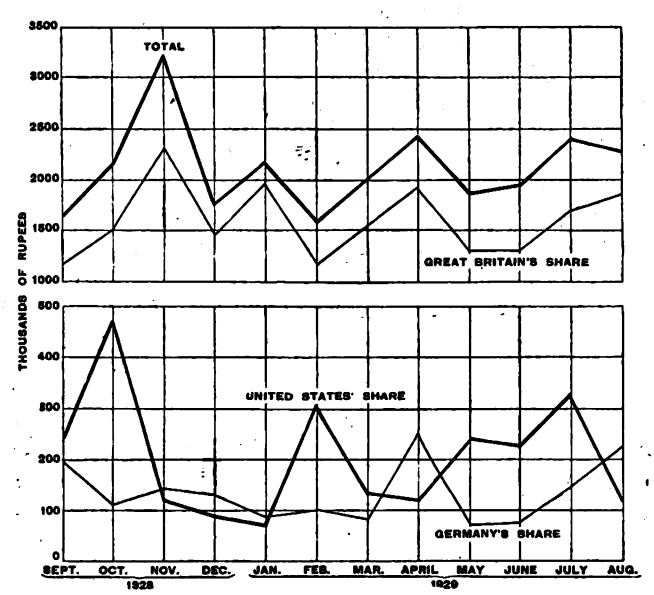

Fig. 5.—Indian Electrical Machinery Imports.

available as soon as the main Pykara scheme might be sanctioned. Orders were placed, the time for starting up being September this year.

With regard to work that is proposed to be done during the coming year, at Pykara, transmission line surveys and specifications will be completed, and construction work will be initiated; at Mettur, plans and estimates will be prepared for a power house at the dam

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and a transmission line to Madras. In addition, investigations into the possibility of generating power from canals near Bezwada will be continued. Speaking at the recent opening of the electrified section from Kalyan to Poona of the Great India Peninsula Railway, Sir Frederick Sykes said that the G.I.P.'s step in main line electrification placed India ahead of England in that field. After referring to the economic advantages of electrification in higher efficiency and saving in costs, the Governor said the real significance of the improved service was that Bombay, as the gateway of India, had to distribute an immense transit traffic to all India, and the electrification of this and the line to Igatpuri would accelerate the process.

The European Glow-lamp Cartel.

The Expiration of the Patents in 1933—1935.

(COMMUNICATED.)

As a number of the main patents protecting the glow-lamp industry will expire between 1933 and 1935, the question has arisen whether there will then be any chance for non-syndicated manufacturers. The lapse of the patents is said to afford an explanation for the pressure exercised by American interests for an inter-connection with the European lamp industry. Under the circumstances special interest is attached to the present situation of most makers in Europe as embodied in the European Glow-lamp Cartel. The question has recently been raised in the Amsterdam *Telegraaf* and in *Die Wirtschaftskurve*.

At the outset it is pointed out that the first place in the production of glow lamps throughout the world is occupied by the United States with from 45 to 50 per cent. of the aggregate figures. The estimates for Germany are from 15 to 20 per cent.; those for Holland from 8 to 9 per cent.; those for England from 7 to 8 per cent.; and those for Japan and Russia from 4 to 5 per cent. in each case. On the other hand, the export figures for the different countries vary considerably and range, it is claimed, from as low as 2½ per cent. of the production in the United States, to as high as 60 per cent. of the output in Holland, so that the latter is the greatest export country in the world. In this connection it is mentioned that since 1926 Holland has discontinued exports of lamps to the United States, and the same observation applies to German exports to America since the close of 1928. Obviously these events are ascribed to mutual agreements with the United States General Electric Company in the matter of the division of markets.

After the German Osram Company the Dutch Philips company is the largest concern in the European Glow-lamp Cartel. During the course of the present year the position of the cartel has been materially strengthened by various events. The Philips company has extended its interests in Belgium and Poland; Philips and Osram have enlarged their participations in the Italian industry; and a further extension has taken place in France, where the Compagnie des Lampes acquired two smaller undertakings, and also in Sweden.

The consolidation of the world industry which has taken place through the strengthening of the position of the American General Electric Company in the European glow-lamp industry is important. The company proportionately increased its former holding in the Philips company in connection with its augmentation of capital, acquired 16⅔ per cent. of the capital in the German Osram company, and entered into closer relations with the Ver. Gluhlampen und Elektricitäts A.G., of Ujpest. Recently, however, rumours have been in circulation on the Amsterdam Bourse that the American General Electric Company has disposed of its holding of shares in the Philips company, while the latter has sold its shares in the American company, so that no mutual interests now exist.

A number of lampmakers are active outside the scope of the cartel. The Allgemeine Gluhlampenfabrik A.G., of Vienna, has carried on a protracted patent action against the cartel. In Sweden the Kooperativa Forbund is conducting an active anti-cartel propaganda, and its factory is to start production in Stockholm late next summer, with an annual production of between two and three million lamps as a beginning, the factory now being in course of erection at the Hammarbyleden. In Holland the efforts of the Splendor Gloeilampenfabrieken seem to have successfully secured an independent existence. However, it is understood that an arrangement has been entered into between the latter and the Philips company under which in some way or other the past keen competition will be avoided and be replaced by co-operation.

Besides the Philips company the most important constituents of the cartel are the Osram concern, which was formed by the Siemens and Halske Company, the A.E.G., and the Auer (Welsbach) Company; the French Compagnie des Lampes, and the English Electric Lamp Manufacturers' Association (Elma). Switzerland and Austria are represented by the Licht A.G., Ver. Gluhlampenfabriken (Goldau), in which capital participation is held by Philips and Osram; and Hungary is concerned through the Ver. Gluhlampen und Elektricitäts A.G., of Ujpest.

The organisation of the cartel took place on January 15th, 1925, through the formation of the Phoebus, A.G. fur die Industrielle Entwicklung des Beleuchtungswesen (the Phoebus Industrial Company for the Development of Lighting), with a share capital of 500,000 Swiss francs. Each of the members of the cartel entered into a separate agreement with this company. Among other matters the contract regulates the interchange of patents and experience; each member may use the patents and methods of production of the other constituents on payment of reasonable compensation. The contract further provides for the organisation of the sales business. Selling is left to the sales organisation of the members, although fixed quotas are arranged and vary according to the development of the different markets. Thus no price cartel exists in the sense that direct and proportionate fixing of prices is one of the essential characteristics of the contract. Definite prices seem only to be prescribed for those countries which either have no glow-lamp industry or only an insignificant one. All the constituents of the cartel are concerned with a large number of other companies through their respective subsidiary companies or are interconnected with each other, the different interests being of quite a complicated nature into which it is unnecessary to enter.

In the case of the Philips company the centre of gravity is now changing over from lamps to wireless apparatus. The annexed table shows the total Dutch exports of the two classes in the first nine months of the current year and in 1928:—

Year.	Lamps. Florins.	Radio apparatus. Florins.
1928	17,491,000	14,074,000
1929	21,397,000	58,924,000

It will be seen that the value of the exports of radio sets, &c., has increased four times in the current year as compared with the corresponding period in 1928, whereas the value of the latter in the first nine months of 1928 was less than that of the exports of lamps.

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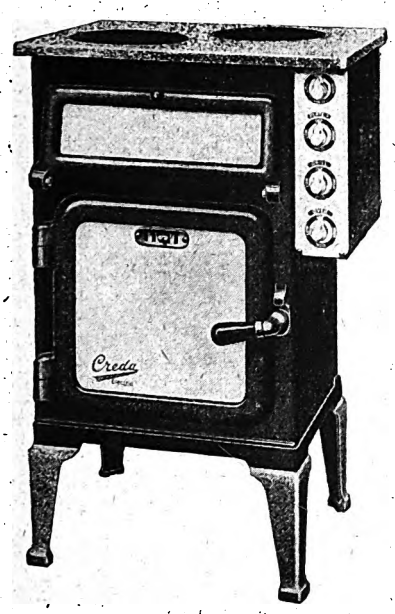
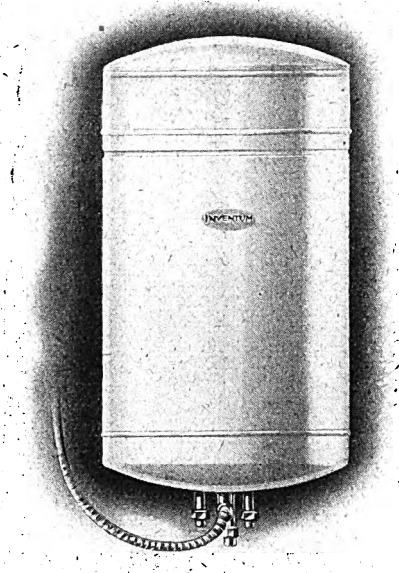
Electricity for the Home.

Notes on the progress made in domestic electrification by the Tunbridge Wells electricity undertaking.

OWING to its situation on the beautiful Kent and Sussex border, and to its medicinal waters, Tunbridge Wells has long been a favourite town of resort and residence. On this account the domestic load is of considerable importance to the municipal electricity undertaking (engineer: Mr. R. N. Torpy, M.I.E.E.), and this fact is thoroughly appreciated. A great deal has been, and is being, done by the Electricity Department to build up the domestic load, and its efforts have been very successful. The water-heating demand, in particular, is of considerable dimensions. The Department has not yet opened showrooms of its own, but steps are being taken to that end. A British Empire Exhibition is held at Tunbridge Wells each year, in October, and the Department and local electrical contractors contribute very largely to the success of the display, while, in turn, the exhibition always leads to additional consumers.





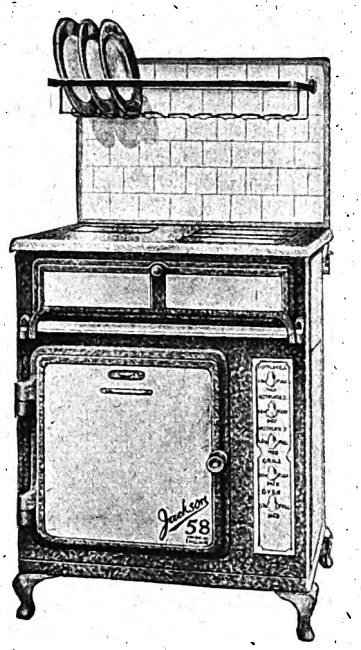


Fig. 1.—A "Creda" Cooker. Fig. 2.—An "Inventum" Water-heater. Fig. 3.—A "Jackson" Cooker.

All wiring work in the Royal Borough is carried out by the local contractors. The Department has an assisted wiring scheme for houses of a rental not exceeding £60 per annum, for which a schedule has been drawn up. The consumer is charged 17 per cent. per annum of the gross cost of the installation over a period of seven years, or 10 per cent. per annum for 14 years, at his option, these rates including maintenance. At the end of the fixed period a nominal rental of 1d. per quarter per lighting point and 2d. per heating point is charged. The cost of a lighting point (including a plain pendant, but not lamp or shade) is 22s. 6d. Heating and cooking circuits cost 1s. 5d. per foot run from the Corporation fuses, plus the cost of the fuseboard, &c. Every effort is made to give the work to the contractor responsible for the introduction of the consumer.

The flat rates are very low, but there are also attractive one for the town and Southborough, the other for outside areas. (The undertaking has an area of supply totalling 400 sq. miles.) The following notes apply to the Tunbridge Wells district:—

The flat rates are very low, but there are also attractive two-part tariffs. There are two methods of assessing the fixed charge. The first is based on the ratable value; for houses up to £10 ratable value the annual charge is 20s., and for larger houses it is 10 per cent. of the ratable value. The other method takes account of the number of rooms; living rooms, halls, &c., are charged at 22s. 6d. per annum and bedrooms at 7s. 6d. In both these tariffs the running charge is ¾d. per kWh. There is also a special domestic rate applicable to premises in which cooking and/or water-heating apparatus is installed. In this the fixed charge is calculated on either of the foregoing bases, and the running charge is only ½d. per kWh. Energy for domestic water-heating can be obtained at a fixed charge per quarter ranging from £3 5s. for a 22-gal. cistern to £1 6s. for a 1½-gal. cistern; this does not include the hire of apparatus. Although not a domestic matter, it is worth mentioning that after-hours shop-window lighting can be done at the special rate of 1d. per kWh plus time-switch rental; no fewer than 250 shops take advantage of these favourable terms.

The Department has an apparatus hiring scheme, but does not sell appliances. This scheme covers cookers, water-heaters, and wash-boilers. The cookers employed are "Creda" and "Jackson" models of various sizes fitted with "Sadia" hotplates, and the charge for them ranges from 5s. to 12s. 6d. per quarter.

There are four "Creda" models available, one of which, the "C.195" (for 4 to 7 persons), is illustrated in fig. 1. This has a "de luxe" finish which employs white vitreous enamel for the oven and hot-cupboard door panels, switchplate and oven sides, and granite grey for the hob, feet, front frame, door frame, and base. There is a mottled removable oven interior and the switchbox cover is in polished aluminium. The oven is 13 in. high and wide and 12½ in. deep, and has a loading of 2,100 W. The grill loading is 1,500 W, and that of the boiling plates is 2,000 W for the 8¾-in. and 1,200 W for the 7-in. plates. There are also four "Jackson" cookers, and we illustrate one of the larger patterns (No. 56) in fig. 3. This, too, is all-enamelled and is provided with a thermometer. It is designed to cater for 14 persons

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and has an oven measuring 19 in. by 15 in. by 17 in., the loading being 2,750 W. The two boiling plates are rectangular; the larger is 8 in. by 7½ in. and is loaded to 1,800 W, and the smaller measures 8½ in. by 6 in. (1,500 W). The grill (11 in. by 8 in.) has a loading of 1,800 W. There is a number of special features incorporated in the cooker, such as the protection and accessibility of the wiring; the mounting and lettering of the switches; and the easily detached elements. The water heaters employed by the Department are of the "Inventum" pattern, the sizes being 1½, 4½, 10, and 22 gallons; the quarterly charge ranges from 1s. 6d. to 5s. 7d. A typical "Inventum" water heater is shown in fig. 2. The wash-boiler supplied at a charge of 2s. 6d. per quarter has a capacity of 10 gallons; it is of galvanised copper and is equipped with a three-heat switch.

The Department has a rapid and efficient maintenance service, and the consumer's convenience is studied in every way. During a recent visit to the undertaking we were shown several letters from satisfied consumers containing very glowing and entirely unsolicited tributes to the Department. In some cases it was stated that the electric way was actually cheaper than other methods, apart from its distinct advantages. Practically every new house in the town is wired for both lighting and other services, and the number of all-electric houses is growing.

Artistic Electric Radiators.

A combination of attractiveness and utility has been efficiently embodied in the "Pellon" radiators

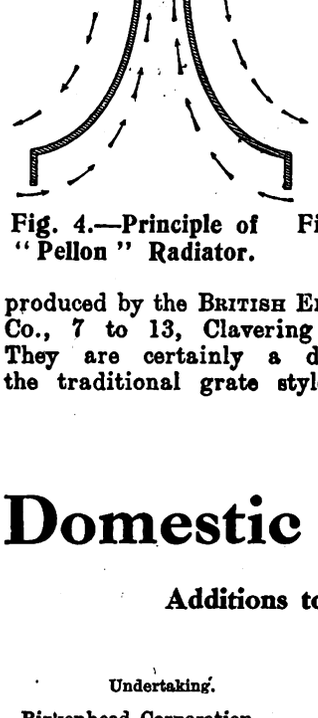

Fig. 4.—Principle of "Pellon" Radiator.

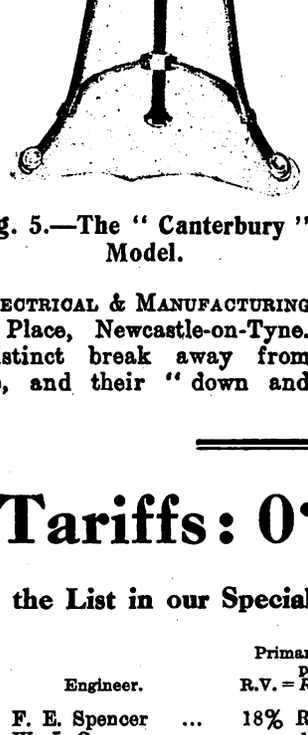

Fig. 5.—The "Canterbury" Model.

produced by the British Electrical & Manufacturing Co., 7 to 13, Clavering Place, Newcastle-on-Tyne. They are certainly a distinct break away from the traditional grate style, and their "down and out" principle of heat distribution is self explanatory from the diagram in fig. 4. Fig. 5 shows the "Canterbury" model which is especially suitable for entrance halls; it can be supplied in any finish to suit requirements. The heating element is situated under the dome, which is chromium plated to prevent discoloration. Between the supports is a brazier slung by three chains and controlled by a separate switch, so that a very pleasant warm glow may be obtained without the use of heat. The loading is 1½ kW for the radiator.

Domestic Supply in Victoria, Australia.

The Victorian Electricity Commission has had a two-part tariff operating for some years, and there is no doubt that the majority of consumers benefits greatly thereby. In the Essendon-Flemington district, which is the only suburban area in which the Commission retails energy, according to the *Electrical Engineer of Australia and New Zealand*, the charge is 1s. per main room per month, plus 1¼d. per kWh. An analysis has been taken of several homes equipped with electric lighting and appliances, and the figures of consumption and costs for average cases are given in the following tabulation:—

No. in family	No. of rooms	Apparatus connected.	kWh per annum.	Annual cost. £ s. d.	Cost per kWh.
4	7	14 lights, 1 stove, 1 iron, 1 kettle, 2 radiators	2,922	19 8 4	1.59
		1 continuous water heater	3,456	9 0 0	1.07
3	4	7 lights, 1 stove, 1 vacuum cleaner, 1 iron, 1 water heater booster	1,290	9 2 5	1.69
		1 continuous water heater	864	2 5 0	1.26
3	5	13 lights, 1 stove, 1 iron, 1 vacuum cleaner, 1 water heater booster	1,722	11 19 5	1.67
		1 continuous water heater	824	2 2 10	1.33
9	10	12 lights, 1 iron, 1 radiator, 1 kettle, 1 stove, 1 washing machine, 1 vacuum cleaner, 1 water heater booster	3,812	23 17 5	1.5
		1 continuous water heater	1,623	4 4 6	1.24
5	7	13 lights, 1 stove, 1 iron, 1 vacuum cleaner	2,714	23 10 11	2.08
3	5	8 lights, 1 stove, 1 iron, 1 radiator, 1 vacuum cleaner	2,060	13 14 7	1.6

Domestic Tariffs: 0·5d. (or less) per kWh.

Additions to the List in our Special Supplement of November 15th, 1929.

Undertaking.	Engineer.	Primary charge basis, per annum. R.V. = *Ratable Value.*	Secondary charge. Pence per kWh.	Hire, hire-purchase, assisted wiring or rental wiring.
Birkenhead Corporation ...	F. E. Spencer ...	18% R.V. (Min. £18)	0.5	H, H-p, and AW
Hamilton Burgh	W. J. Cooper ...	15% R.V.	0.5	H-p
Leigh Corporation	J. B. Hudson ...	12½% R.V. (Min. £16)	0.5 after 5 kWh per qtr. per £ R.V.	H, H-p, and AW
Luton Corporation	W. H. Cooke ...	—	0.5	None
Sale U.D.C.	C. J. Wood ...	£20, £15 and £10 R.V.	0.5	H, H-p, AW and RW
Stretford U.D.C	T. A. Kerr ...	15% (Min. £10)	0.5	AW

Referring to the "Domestic Tariffs" inset in our issue of November 15th, the following should be noted: The charges given for the Bradford Corporation electricity undertaking relate to half-yearly periods, and those for the Liverpool Corporation electricity undertaking relate to quarterly periods.

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Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

E.D.A. Sales Conference.

At the first of the 1929-30 E.D.A. Manchester Sales Conferences, which was held at the Lighting Service Bureau, on November 20th, Mr. R. J. Hebbert, of Ferranti, Ltd., read a paper on "Domestic Water Heating." He said that there were several large water-heating installations now in hand in this country, for which electricity was to be supplied during off-peak hours at prices of ½d. per kWh and less. A good load factor would justify a low tariff. All types of water-heating were not entitled to low tariffs. Certain types represented a bad form of load, which economically should be charged for at a high rate. The instantaneous geyser capable of a furnishing a hot bath in ten minutes ought not be be rated at less than 20 kW, and a number of them would represent a very troublesome load. It could not be too strongly emphasised that anything in the nature of a circulating pipe system to give instant hot water at the taps was prohibitive, on account of the loss of heat entailed. He was of the opinion that a storage capacity of 20 gallons represented the smallest size of heater that should be recommended for special supply to individual outlying hot water points. It was advisable, in order to make the most of the heat storage capacity, that the thermostat should be set as near as possible to the boiling point of the water. On the question of the price at which the use of electricity for water-heating could be made economically attractive to the consumer, from personal experience at ½d. per kWh, electric heating of water for the small household did compare favourably with cost of equal service obtainable by any other means. It was noteworthy that the areas in which the water-heating load had been most successfully encouraged were those in which the apparatus was offered on terms of hire. Those supply authorities who were in a position to offer rates of less than ½d. per kWh would probably find it more profitable rather to take this opportunity to charge a little more for the energy and devote some part of the expected additional revenue to assistance in the capital cost of the consumer's installation.

Ideal Home Exhibition Competition.

Entrants to the competition for British architects, decorative artists and electrical contractors organised by the *Daily Mail* in conjunction with the General Electric Co., Ltd.—the winning designs of which are to be incorporated in the "Pavilion of Light" which the company has undertaken to erect at the Ideal Home Exhibition at Olympia in March—are reminded that designs and schedules should be addressed and despatched so as to arrive at *Daily Mail* Electrical Competition, Carmelite House, E.C.4, not later than midnight December 14th. It is stipulated that no name or mark or sign must be placed on the drawings, or on the package containing them, by which the author may be identified. Drawings must be packed flat in a sealed package, and be accompanied by an opaque envelope (which must be securely fastened to the drawing) containing the name and address of the author, with a declaration that the design is his or her own personal, original work, and that the drawings have been prepared under his or her own personal supervision.

Catalogues Wanted.

Mr. E. MARSDEN, the new electrical engineer of Louth, Lincs., asks for manufacturers' catalogues, &c.

Recent Contracts.

It is announced that Messrs. BABCOCK & WILCOX, LTD., have received an order from the Cia Italo-Argentina de Electricidad, Buenos Aires, for the initial section of the boiler-house equipment for the Nuevo Puerto "super"-power station; the value of the order is put at £282,000. Another contract received by the company is for the boilers in the new power station of the Bahia Blanca Electric Co., having a value of about £65,000.

Among recent contracts obtained by HOLOPHANE, LTD., is one for the complete lighting installation at the new Egyptian University, Ghizeh. A number of large and special fittings are to be installed in the new buildings.

Messrs. W. CROCKATT & SONS, LTD., have recently received orders for their "Crockatt-Simplex" patent electric salinometer from the Chilean Naval Commission (twelve sets); the Imperial Government Railways, Tokio (large outfit with motor-generator set and switchboard); a large Italian shipyard (two outfits); and the British Admiralty.

An order for steelwork in connection with the electrification of the Manchester-Altrincham line, valued at about £50,000, has been placed with Messrs. EDWARD WOOD & Co., LTD., Trafford Park, Manchester.

Electricity in Tanganyika.

The Times reported on November 19th that one of the questions to be raised at last week's meeting of the East African Section of the London Chamber of Commerce was the delay in the adoption of a scheme for supplying electrical power to Tanganyika Territory, which has been under discussion for two or three years. Part of the proposed scheme involves the utilisation of the Pangani River Falls, and it was stated in July that two out of five tenders then remained for further examination, and that a decision was likely to be given at the beginning of August. There was then a further delay, and commercial firms were informed that a definite decision would be reached by the end of October. The necessary work involved in this plan was expected to occupy about two years, and to involve an outlay of about £250,000, while the cost of the complete scheme for supplying electricity to the ports of Dar-es-Salaam and Tanga and inland territory has been estimated at twice that sum. The continued delay in reaching a decision on terms is regarded by commercial firms as especially unfortunate as the sisal and other industries are progressing rapidly. It is suggested that in the absence of a big scheme, such as has been proposed, they may feel compelled to equip their plantations further with motor-engines, and there might then not be the same opportunity for utilising to the full the electrical power if and when it is ultimately provided.

German Electricity Supply Profits.

A return lately issued by the German Government Statistical Department shows that during last year 64 electricity supply concerns in Germany, with a combined share capital of £35,760,000, reported a total net profit of £2,765,000, equal to approximately 7.4 per cent., as against 7.2 per cent. in 1927. Of the net profit £2,530,000 was distributed in dividends to the shareholders, the average dividend being 7.07 per cent, as compared with 7.09 per cent. in the preceding year.

New German Companies.

The following companies have recently been formed in Germany in connection with electricity supply. The Hanover Stromversorgungs Gesellschaft, Hanover, capital £300,000; and the Teltower Kreiswerke Gesellschaft, Nowawes, capital £320,000.

Patent Application.

The Société Alsacienne de Constructions Mécaniques has applied for the restoration of Patent No. 245,776 relating to "Improvements in or relating to welding or cutting by electric arc," which was allowed to lapse in January last. Notice of opposition must be lodged with the Patent Office by January 20th next.

The Committee on Finance and Industry.

The Committee on Finance and Industry which the Government recently appointed under the chairmanship of Mr. H. P. Macmillan, K.C., held its first meeting on November 21st. Procedure and the nature of the evidence to be taken were discussed.

Effects of the Wall Street Crisis.

It was announced last week that among the other events taking place in the United States with a view to lessening the effects upon trade and industry of the Wall Street slump in security values, there had been held a conference between the President and other statesmen and the railway authorities, at which the latter had undertaken not to reduce their forward programmes for construction work. The *Times*, quoting the American *Financial Chronicle*, now reports "that the gross earnings of seven railroads in the second week in November decreased 16.23 per cent."

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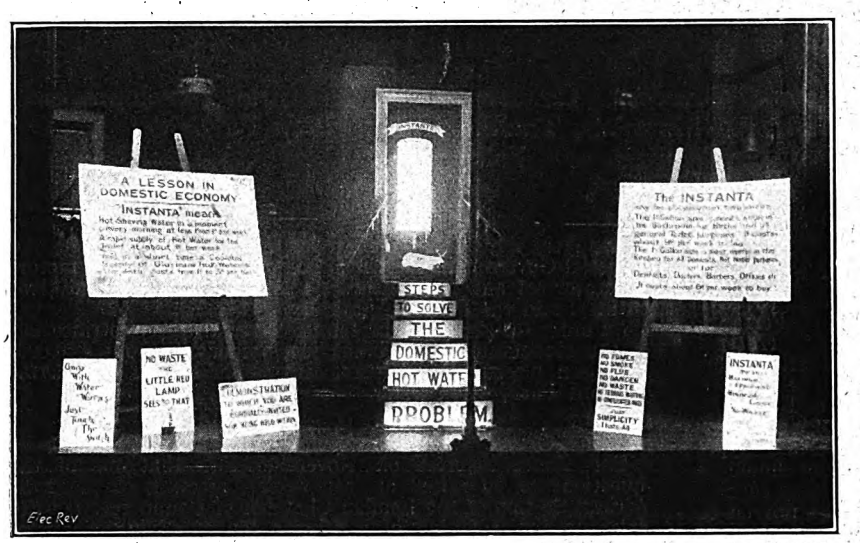
A Novel Water-heating Demonstration.

The Southampton Corporation Electricity Department (engineer: Mr. W. G. Turner) has recently arranged its window in a novel fashion to advertise the virtues of electric water heating. As will be seen from the accompanying picture a staircase has been set up in the centre leading up to the open door of a bathroom. On the risers of the stairs there are illuminated cards giving an appropriate message. Apart from these cards the demonstration commences in darkness. A shadowy form runs up the stairs into the bathroom, the inside of which is suddenly and brilliantly illuminated, revealing a large white-enamelled storage geyser mounted on the wall with another, smaller, model resting on a cushion on the floor. The water-heaters employed are of the "Instanta" pattern (made by Messrs. Chas. Joyner & Co.) in 11-gal. and 1½-gal. sizes. Cards arranged about the window give details of the system and its advantages.



A Water-heating Display at Southampton.

Change of Address.

The address of the Chester City Electricity Department is now 22, Northgate Street. (Telephone: Chester 1562-3.)

Social Events.

The first dance of the season was held at Magnet House on November 8th, when there was a good attendance. The arrangements were in the capable hands of Miss Harbour and Mr. Nash, and a very successful evening was the outcome. On November 9th a social evening was held at Magnet House, when the "Wilson" and "Byng" tennis challenge cups were presented to the winning teams by Mrs. F. P. Driver in the unavoidable absence of the donors, Mr. C. Wilson and Mr. E. G. Byng. These trophies were won by the Osram Lamp Works men's team and the Magnet House (London) ladies' team, respectively. Singing and dancing interspersed with conjuring and ventriloquial entertainments by various G.E.C. "stars" contributed towards a very pleasant evening.

Visit to Osram Lamp Works.

A representative party of East Anglian Corporation and railway engineers visited the Osram Lamp Works, Hammersmith, recently. Much time was spent in witnessing a number of interesting manufacturing operations during the morning, after which the party were entertained to luncheon by Mr. C. Wilson, managing director of the Lamp Works, who extended a hearty welcome to the visitors. Subsequently the Osram Glass Works and the G.E.C. Research Laboratories were visited, and many new developments were inspected. Mr. F. Crush, manager of the Ipswich branch of the company, acted as guide to the party, which included Messrs. T. Edge, G. L. Garton, F. A. Fairhead and A. Starratt (Ipswich Corporation), A. C. Green (Norwich Corporation), W. C. Cooper (Bury St. Edmunds), Mr. Chapman and Mr. Baker (Colchester), with Messrs. C. N. Brown and A. G. Smith of the L.N.E.R. (Ipswich) Electrical Engineers' Department.

Merchandise Marks Inquiry.

Motor vehicle chassis and parts and automobile batteries will form the subject of the next inquiry by the Standing Committee under the Merchandise Marks Act, 1926. Communications should be directed to the Secretary of the Committee, New Public Offices, Great George Street, S.W.1.

Wages in the Cable-Making Industry.

The Joint Industrial Council for the Electrical Cable-Making Industry informs us that there will be no cost-of-living change in wages in the industry on the third pay day in December.

New Italian Companies.

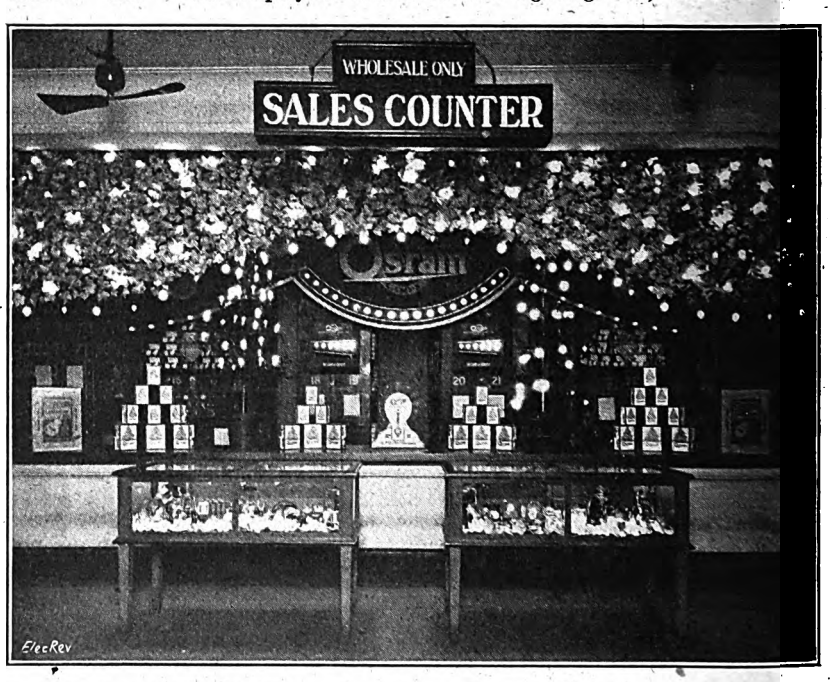
Among the companies recently formed in Italy are the Società delle Officine Elettromeccaniche Perego e Cia, Milan; La Società Ligure Lombarda Elettrotechnica, Milan; La Società Impianti Linee Elettriche Telefoniche, Milan; La Società Elettrica Valdostana, Turin; and La Società Fabbrica Lampada Elettriche de Montel Fled, Rome.

Employment during October.

According to the November *Ministry of Labour Gazette*, employment in the engineering industry last month was still slack, although upon the whole there was a slight improvement. In the electrical engineering branch conditions remained fairly good. The number of unemployed in the engineering industry as a whole declined from 93,750 to 90,536, the proportion falling from 9.3 to 9.0 per cent. The electrical engineering section recorded a decrease of 20 in the number of unemployed (3,462), and the percentage (4.1) remained unaltered. In the electrical cable, wire, and lamp manufacturing group the number of unemployed increased from 3,761 to 3,791, but the proportion remained at 4.0 per cent. The number of unemployed in the electrical wiring and contracting industry rose from 1,007 to 1,047, and the percentage from 6.1 to 6.3. Readers who follow these figures month by month will notice that the percentages given for September have been altered. This is due to a revision based on the numbers insured in July last; the figures originally given were calculated on the numbers insured in July, 1928. The latest statistics give the following as the estimated numbers employed in the branches of industry with which we deal:—Engineering, 1,003,280; electrical engineering (included in engineering), 84,430; electrical cable, wire and lamp manufacturing, 93,970; electrical wiring and contracting, 16,610.

A G.E.C. Christmas Display.

The accompanying illustration shows part of the trade counter of the General Electric Co., Ltd., at Magnet House, Kingsway, W.C.2. This has been specially decorated for the Christmas season and is devoted mainly to lighting. "Osram" lamps are used in a generous manner and the main feature is the display of Christmas-tree lighting sets, some of which are hidden in the foliage with which the upper part is decorated. Cartons containing these sets are arranged on the counter, while in two showcases at the front there are examples of some of the company's smaller products—kettles, handlamps, toasters, &c.



The G.E.C. Trade Counter Decorated for Christmas.

Unemployment.

There was an increase of 7,142 in the number of registered unemployed during the week ended November 11th. At that date the total was 1,259,100, as compared with 1,251,958 on November 4th, and 1,348,158 on November 12th, 1928.

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Municipal Trading at Nottingham.

As a result of an appeal by local electrical contractors, the Nottinghamshire and Derbyshire Traders' Association has forwarded to the Corporation, which proposes shortly to open new electricity showrooms, objections to any extension of municipal trading. Members of the Electrical Contractors' Association have also communicated to the Corporation Electricity Committee proposals that it should limit its trading to the following activities:—(1) Assisted wiring by direct labour only in Corporation property and workmen's houses paying under 10s. per week rent and rates; (2) te sale or hire-purchase of fittings, fires and accessories thereto and electrical conductors; (3) the hire of electrical cookers direct to the public. The Association also suggests that assisted wiring (other than that stated in clause 1) should be done by means of competitive tenders from the electrical contractors.

New Metro-Vick Premises at Newcastle.

The Newcastle branch of METRO-VICK SUPPLIES recently moved into new premises affording a great deal more accommodation. As will be judged from the illustration herewith the new building is of handsome proportions and a good example of modern architecture. It is situated at the corner of Northumberland Road and Ridley Place, facing the City Hall on one hand and the "Hippodrome" on the other. Thus it is conveniently situated in a developing part of the city. Floodlighting fittings can be seen in the picture.

The Exterior and the Lighting Fittings Showroom of the New Metro-Vick Supplies Branch, Newcastle.

We also reproduce a view of the showrooms. This section is devoted to lighting fittings which have been effectively arranged. The general decorative scheme is blue and silver. In addition there is a suite of model rooms—drawing room, bedroom, bathroom, kitchen, &c.—in which electrical domestic appliances are shown in operation.

Book Notices.

Congratulations to our contemporary, the *Indian Textile Journal*, of Bombay, upon reaching its fortieth year of publication. The occasion is celebrated by the issue of a special number dated October 31st which contains a survey of the textile industry of India, and the progress made by cotton mills, giving at the same time information regarding the part contributel by the journal in stimulating industrial development and financial enterprise. One of the lengthiest articles is a fully illustrated description of a new cotton mill with the most up-to-date machinery.

BRITISH INSULATED CABLES, LTD., has published an interesting brochure dealing with the Central Scotland Electricity Scheme. It describes the work of linking up the principal generating stations in the area carried out by the company. There are a number of illustrations, which show the different kinds of tower employed for the transmission lines, &c.

We have received a copy of the first number of *Metallurgia*, a monthly magazine (2s. 6d.) which is to be devoted to the interests of the British metal industries. It is issued by the Kennedy Press Ltd., of Manchester.

"An Outline of Advertising," by E. O. Hughes. Pp. xii+162; illustrated. Price 7s. 6d. net. London: Chapman and Hall, Ltd.

"High Voltage Cables," by L. Emanueli. Pp. vi+107; figs. 81. Price 8s. 6d. net. London: Chapman & Hall, Ltd.

The Melbourne and Metropolitan Tramways Board has produced a booklet describing the growth and development of the tramway system of the metropolis since the inauguration of the Board in 1919.

"The Practice of Spectrum Analysis with Hilger Instruments," compiled by F. Twyman, F.Inst.P., F.R.S. Fourth edition. Pp. 38. Illustrated. London: Adam Hilger, Ltd. Price 1s. 6d. net.—The purpose of this compilation is to supply a guide to those intending to take up spectrum analysis for practical purposes, and the contents include chapters on spectrometers and spectrographs, quantitative spectrum analysis, various types of spectrum, &c. The production of this publication is good and it should prove of use to those interested in the subject.

"Theory and Practice of Alternating Currents," by A. T. Dover. Second edition (revised). Pp. xv+539; figs. 303. London: Sir Isaac Pitman & Sons, Ltd. Price 18s. net.

"Heaviside's Operational Calculus," by E. J. Berg. Pp. xiii +214; figs. 64. London: McGraw-Hill Publishing Co., Ltd. Price 15s. net.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLVIII. Number 1929. No. 11. New York: The Institute. Price $1.

The A.C.E.C.'s Twenty-five Years.

The ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI celebrate their 25th anniversary this year, and to mark the occasion have published a special issue of their Quarterly Review. In this the history of the concern is outlined, and particulars are given of the evolution of the construction of electrical machinery, apparatus and cables during the period. It is pointed out that the A.C.E.C. are the successors of the Société "Electricité et Hydraulique," which was founded in 1886, and equipped the first central station in Charleroi, and installed the Ostend electric lighting scheme. By a melancholy coincidence the death of the founder of the A.C.E.C., General Baron Empain, occurred recently. An inset containing a memoir and portrait is included in the Review. The publication is very well illustrated with views of the A.C.E.C. works. The whole of the text is in French.

Trade Announcements.

Messrs. GEO. L. SCOTT & CO., LTD., 60-66, Rochester Row, S.W.1, have taken over the representation of the interests of the Forges et Ateliers de Constructions Electriques de Jeumont from Mr. E. E. Garrard, 82, Victoria Street, S.W.1, and are in a position to quote for paper insulated cables and bare copper wire.

Messrs. HEWETSON, SON & CO., of London, have opened a branch business at 8, King's Road, St. Leonards, Hastings, for radio and electrical work.

To cope with expanding business, the HENDERSON WIRELESS AND ELECTRICAL SERVICE has taken over the whole of the corner premises of 54, Queen's Road, Brighton.

The Lincoln district office of CALLENDER'S CABLE & CONSTRUCTION CO., LTD., is now at 5, Broadgate. (Telephone: 654; telegrams: "Callender, Lincoln.") Stocks of v.i.r. cables and flexibles are available at the new address.

On and after December 7th the address of BRITISH BROWN-BOVERI, LTD., will be 56, Victoria Street, S.W.1. (Telephone: Victoria 1603-4; telegrams: "Reactance, Sowest, London.")

New French Company.

A company has been formed in Paris (80, Boulevard Republique) with the title La Société Auto-Câble, Fabrique de Fils et Câbles et Equipement Electrique des Automobiles, to manufacture electric wires and cable for use on motor vehicles.

Wages in the Engineering Industry.

On November 21st there was a conference in London between representatives of the Engineering and Allied Employers' Federation and of the trade unions in the engineering industry. The unions again put forward their request, which was deferred in May last, for an increase of 8s. per week in the wages of time workers with corresponding increases in piece-work rates. For the Federation, Sir Allan Smith pointed

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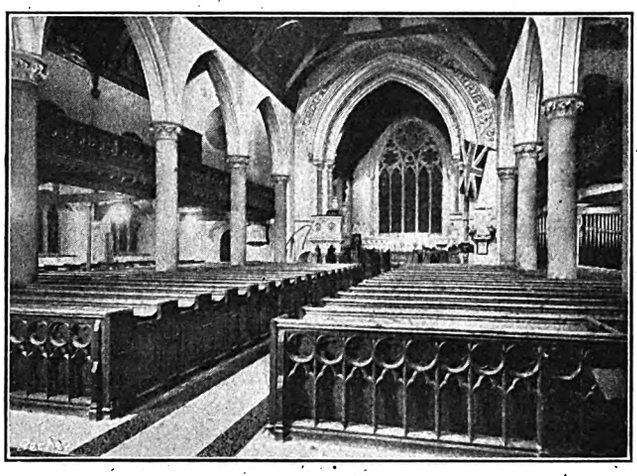
to the uncertainty which existed with regard to the Government's handling of the unemployment problem and the added burdens of social services. The Government's disarmament policy, too, was bound to have serious effects upon the industry. Therefore, although the employers were willing and anxious to pay higher wages they found it impossible at present to concede any increase.

The employers' decision is to be discussed at a meeting in January when future action will be considered.

A Church-Lighting Installation.

The modernising of the electric lighting installation in the Immanuel Church, Streatham, S.W., has recently been completed by Messrs. Thorne & Hoddle, Ltd. In the old direct-lighting scheme the installation consisted of four-light chandeliers down the centre aisle and in the chancel, and five-light chandeliers both under and over the gallery. In the new scheme the chancel and nave are lit by reflectors concealed in



The Lighting in Immanuel Church, Streatham.

the roof and the space under the galleries by small Holophane fittings. For the lighting of the nave sixteen "Stilleto" 100-watt reflector fittings are used. The side aisles are lighted by four refractor reflector 150-watt fittings under each gallery, and the choir by six fittings similar to those used in the nave, three being fixed on either side and concealed behind the wall of the chancel arch. The altar itself is illuminated by two similar fittings concealed behind the roof trusses. The accompanying illustration shows the effect of the new illumination.

Bankruptcy Proceedings.

G. E. Ward, dealer in wireless accessories, 13, Queen's Road, St. John's Wood, N.W.—An application was made on November 19th to Mr. Registrar Mellor, at the London Bankruptcy Court, for an order of discharge on behalf of this bankrupt, who failed in December, 1927, with payable claims of £450, and assets of £20. According to the Official Receiver's report, the applicant, in 1922, purchased 28,000 accumulators from the Disposals Board for £7,000; he rented an office at 79, Mark Lane, E.C., and traded as the City Accumulator Co. The trading was very successful; he subsequently purchased many parcels of wireless accessories from the Disposals Board, and opened shops at 10, Rupert Street, W.; Bournemouth; 10, Rangoon Street, E.C.; and Central Street, Leeds. In April, 1925, following upon embezzlements by employés and a slump in the wireless trade, he became short of liquid capital, and C.A.C. Radio, Ltd., was formed, with a capital of £20,000, to take over the various businesses. The company was not successful, and went into liquidation in May, 1926. After the liquidation the bankrupt was pressed by creditors, and he filed his petition. He attributed his insolvency to the collapse of C.A.C. Radio, Ltd., and to his liability for debts which the company agreed to take over, but failed to discharge. The only fact reported in opposition to the application was the insufficiency of assets to equal 10s. in the £ on the amount of the liabilities. His Honour granted a discharge subject to judgment for £2, to be satisfied by an immediate cash payment.

W. H. Thornton, electrical and wireless engineer, Bridge Street, Burnley.—This debtor appeared for examination at the Burnley Bankruptcy Court on November 19th. He attributed his deficiency of £635 to shortage of capital, bad trade, and keen competition. He said that from 1922 to 1926 he was employed as a radio manager in Burnley at £250 a year. In 1926, the firm was taken over by two limited companies, and he was appointed director and secretary of each company. In July, 1927, the companies, in which he had 300 £1 shares, went into liquidation, the assets being insufficient to make a return to shareholders. In 1927, he commenced business as an electrical and wireless engineer with a capital of £23. The business was successful for twelve months, but he executed a deed of assignment in April this year. At present he was employed by a firm of electrical engineers. The examination was adjourned to be closed.

Mabel Woolldridge (trading as the Woolldridge Radio Co.), 26 & 39, Lisle Street, W.C.—This bankrupt, who failed in October, 1928, applied on November 19th, at the London Bankruptcy Court, for an order of discharge. The Official Receiver reported that the provable claims amounted to £332 and no assets were disclosed. The applicant began business in 1923 with another person as wireless dealers at 39, Lisle Street, under the style of "S. Hawkins." The partner withdrew in 1924, and the bankrupt continued the business alone until the end of 1925, when she closed down and sold the stock. In May, 1926, she restarted at the same address under the style of the "Woolldridge Radio Co."; that business was acquired by a company, of which the bankrupt was appointed a director; it did but little business, and a receiver was appointed by a creditor in August, 1928. Early in 1927 the bankrupt also started as a wireless dealer in her own name at 22, Lisle Street; that business was acquired in May, 1927, by "M. Woolldridge (Wireless), Ltd.," and she was again appointed a director, which post she held at the date of her failure. The bankrupt attributed her insolvency to liabilities incurred on behalf of a company, for which she was held personally responsible, and to law costs. The discharge was suspended for three months.

Williams & Gill, 1, Station Road, Church End, Finchley, Middlesex, lately electricians.—The public examination of these debtors was held on November 14th, at the Court House, Barnet. A statement of affairs was presented showing liabilities of £1,132, against assets estimated to produce £14, leaving a deficiency of £1,118. The separate estate of the debtor Gill showed liabilities of £44, and assets of the estimated value of £3. The debtor Davidson had liabilities of £207, and no assets. It would seem that the debtors formerly traded together in partnership as Williams & Gill, the business being started in 1914 by the debtor Gill and another. Davidson became a partner some years later, and subsequently the other partner retired. In July, 1928, Davidson left the business. The examination was closed.

F. H. Graham, 14, Hilltop Avenue, Harehills, Leeds, electrician. The following are creditors in this recent failure:—

	£		£
Electric Lamp Factors	70	Scattergood & Johnson,	
Metcalf & Co.	77	Ltd.	33

J. Cameroff, 147, Spencer Place, Leeds, electrical engineer. The following are creditors in this recent failure:—

	£		£
Milne & Needham, Ltd.	274	Electric Conduits, Ltd.	...25

Ivy Turner, wireless dealer, 103a, Little Ilford Lane, Manor Park, E.—This debtor attended on November 19th at the London Bankruptcy Court, and passed her public examination upon accounts showing liabilities of £51 and assets of £8. She stated that in 1924 she began dealing in electric lamps under the style of Turner's Cash Co., and a year later she traded as a wireless dealer in the name of I. Y. Turner & Co. The business gradually declined, and, a writ having been issued against her to recover £21, she filed her petition.

G. Cohen, electrical engineer, 49, Newman Street, Oxford Street, W.—Application for discharge to be heard at 1, Carey Street on December 11th.

H. H. D. Radcliffe & F. Haddleton (City Electric Services), electrical engineers, 51, Islington Row, Birmingham.—Last day for proofs for dividend December 4th. Trustee, Mr. C. Hoult, Official Receiver, 191, Corporation Street, Birmingham.

F. Price & C. Tarver (F. Price, Tarver & Co.), electrical engineers 15, Working Street, Cardiff.—Last day for proofs for dividend December 4th. Trustee, Mr. E. Owen, 34, Park Place, Cardiff.

H. Gascoigne, wireless dealer, &c., 40, Cricklade Street, Cirencester.—Receiving order made November 19th, on debtor's own petition.

A. Angers (A. Angers & Co.), electrician and mechanical engineer, 10, Hatton Garden, Liverpool.—Trustee, Mr. J. Allcorn, Official Receiver, Government Buildings, Victoria Street, Liverpool, released November 11th, 1929.

T. F. Collier, electrician, 116, Union Street West, Oldham.—Trustee, Mr. J. D. Turner, Official Receiver, Byrom Street, Manchester, released November 15th, 1929.

J. J. Latham, wireless dealer, &c., 3, Brickhouse Street, Burslem.—First and final dividend of 10d. in the £, payable December 2nd at the Official Receiver's office, 12, Lonsdale Street, Stoke-on-Trent.

E. G. M. Page, dealer in wireless sets and accessories, 46, Bohemia Road, St. Leonards-on-Sea.—First and final dividend of 20s. in the £, payable at the Official Receiver's office, 12a, Marlborough Place, Brighton.

Company Liquidations.

Accumulators of Woking, Ltd.—The notice published here last week referred to a purely formal meeting, to be held on December 17th, in connection with the liquidation, last year, in which the present company (Accumulators of Woking (1928), Ltd.), took over the business as a going concern. We understand that the present company has materially benefited from the financial and manufacturing re-organisation that has taken place.

Manchester Magneto Co., Ltd.—A meeting of members is called for December 23rd at the offices of Messrs. A. L. Price and Co., 8, Exchange Street, Manchester, to hear an account of the winding up from the Liquidator, Mr. A. L. Price.

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Local Exhibition.

Harle Syke (Burnley).—Alderman H. R. Nuttall, J.P., Mayor of Burnley and chairman of the Electricity Committee, on November 21st, opened an exhibition of electrical appliances at Harle Syke. He said that the day was long past when electricity was regarded as a luxury. Every home ought to have an abundant and cheap supply, for electricity was a big saver of labour, and was safe and clean.

A Hand-Lamp Window Display.

Batteries, Ltd., Redditch, has sent us a photograph of a window display which it has designed for the use of dealers in its "Nife" hand-lamps, which are equipped with "all-steel" accumulators. It is a simple but effective aid to selling. The company has also sent us a price list of these lamps and low-tension accumulator batteries for radio.

New Catalogues and Lists.

Siemens Bros. & Co., Ltd., Woolwich.—A showcard illustrating in colour a merry magician producing a number of "Xcel" appliances.

General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Folder L.5234 containing illustrated particulars of "Magnet" bakelite electric bells and accessories; and List No. SL. 4986, dealing with stage spotlights suitable for theatres, kinemas, concert halls, &c. Interesting and seasonal features of the "Osram G.E.C. Bulletin" are illustrated articles on Christmas gifts and decorative lighting for Christmas.

Shaftesbury Radio Co., 184-188, Shaftesbury Avenue, W.C.2.—Two illustrated leaflets describing the company's range of loud-speakers, units, &c. Priced.

Messrs. Adam Hilger, Ltd., 24, Rochester Place, Camden Road, N.W.1.—A well-produced brochure containing useful information on the choice of spectrographic outfits for metallurgical analysis, illustrating the company's wide range of products with prices.

Messrs. Ward & Goldstone, Ltd.—A pamphlet containing details of the "Mepic" electric shop window heater, the "Cozytowz" footwarmer for motor cars, and immersion heaters.

Messrs. J. J. Eastick & Sons, Eelex House, 118, Bunhill Row, E.C.4.—The November issue of "Eelex Radio Bulletin" contains, in addition to notes on the company's activities and products, a number of news items of interest to the radio trade.

Messrs. Mortimer & Gall, 26, Cheapside, E.C.2.—A card drawing attention to "Peter the Heater" for motor-car radiators.

Drayton Regulator & Instrument Co., Ltd., West Drayton, Middlesex.—A descriptive pamphlet dealing with the Drayton-Nicholson & Drayton differential steam traps.

Messrs. A. H. McQueen & Co., Ltd., 182, West George Street, Glasgow.—A pamphlet describing the "Whelan" stud stump extractor, and another dealing with switchboards manufactured by the company. Illustrated.

Light Radiators, Ltd., Medway House, Old Cavendish Street, W.1.—A broadsheet describing the company's day and night signs.

Messrs. Falk, Stadelmann & Co., Ltd., 83-93, Farringdon Road, E.C.1.—Pamphlet No. P.1,375, containing an illustration and full details of the "Efesca" vacuum cleaner and attachments, together with a covering letter making a special offer to the trade.

The Carrier-Ross Engineering Co., Ltd., Victory House, 101, Regent Street, W.1.—An illustrated brochure describing the "Carrier-York" heat-diffusing system.

Electric Art Shades (1928), Ltd., Feering Factory, Kelvedon, Essex.—A priced and illustrated leaflet describing the company's new table standard.

Messrs. A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—Pamphlet No. 777 describing the company's metal-clad air-break switches, fuses and plugs. Illustrated and priced.

Benjamin Electric, Ltd., Brantwood Works, Tariff Road, N.17.—A publication entitled "Blindfolded and Handcuffed," dealing with the benefits of correct lighting in industry.

N.V. Transelectra, Sarphatistraat, 43, Amsterdam.—Two illustrated price lists of "Ferram" electric lamps, lamp-caps, &c.

Messrs. L. Andrews & Co., 2, Whitworth Street West, Deansgate, Manchester.—A price list of "Wrendal" and "Capella" lamps.

Messrs. William McGeoch & Co., Ltd., 28, West Campbell Street, Glasgow.—Two illustrated publications dealing with "Klidos" cargo-connection boxes and "Lock-up" electric light fittings.

Messrs. J. H. Evans & Co., 31, Dickinson Street, Manchester.—An illustrated leaflet drawing attention to the "Rightway" wheel drawer.

Messrs. Isenthal & Co., Ltd., Ducon Works, Victoria Road, North Acton, W.3.—List C.1029, describing, with illustrations, "Carola" photo-electric cells and vacuum relays. Priced.

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, W.C.2.—A comprehensive illustrated list of electric fires containing examples of most of the leading makers' models, as well as "Sunco" designs. Priced.

The English Electric Co., Ltd., Queen's House, Kingsway, W.C.2.—Three illustrated descriptive publications:—K.43, the "English Electric" power-factor compensator; K.62, electric trolley-'buses; and K.66, "English Electric" air-operated controller for electric trolley-'buses.

Messrs. A. C. Cossor, Ltd., Highbury Grove, N.5.—An illustrated sheet showing the construction of the 1930 Cossor "Melody Maker."

Messrs. Stewarts & Lloyds, Ltd., 41, Oswald Street, Glasgow.—A well-produced, illustrated catalogue of tubular steel poles for tramways, telephone lines, and other purposes. Very complete details are given of the various types.

Equipment & Engineering Co., Ltd., 2 & 3, Norfolk Street, Strand, W.C.2.—A leaflet drawing attention to the "Eco" double jet hot air hand dryer.

Prices of Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.	Price Nov. 26th.	Fortnight's inc. or dec.
a	Acid, Oxalic ... ... per lb.	5¾d.	...
a	Ammoniac, Sal ... ... per ton	£60	...
a	Ammonia, Muriate (large crystal) ,,	£52	...
a	Bisulphide of Carbon ... ... ,,	...	...
a	Borax ... ... ,,	£25	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... ... per lb.	3½d. to 4d.	...
a	,, Perchlorate ... ... ,,	5½d.	...
a	Shellac ... ... per cwt.	£13 10s.	...
a	Sulphur, Commercial ... ... ,,	£11	...
a	,, Roll ... ... ,,	£11	...
a	Soda, Chlorate ... ... per lb.	3d.	...
a	,, Crystals ... ... per ton	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	3⅝d.	...
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton	£95 to £100	...
b	,, Wire ... ... per lb.	1/1 to 1/9	...
b	,, Sheet ... ... ,,	1/1 to 2/9	...
p	Babbitts Metal and Anti-friction Metals—		
	Grade I ... ... per ton net	£175	£11 inc.
	Grade II... ... ... ,, ,,	£122	£6 inc.
	Grade III ... ... ,, ,,	£68	£3 inc.
c	Brass (rolled metal 2" to 12" basis) per lb.	10⅝d.	...
c	,, Tubes (solid drawn) ... ,,	1/0¾ to 1/1	...
c	,, Wire, basis ... ... ,,	10¼d.	½d. inc.
c	Copper Tubes (solid drawn) ... ,,	1/3	...
g	,, Bars (best selected) ... per ton	£110	...
g	,, Sheet ... ... ,,	£110	...
g	,, Rod ... ... ,,	£110	...
d	,, (Electrolytic) Bars ... ,,	£84	10/- inc.
d	,, ,, Sheets ... ,,	£143 10s.	...
d	,, ,, Wire Rods ,,	£90	10/- inc.
d	,, ,, H.C. Wire per lb.	11⅝d.	⅛d. inc.
f	Ebonite Rod... ... ... ,,	2/3 to 2/6	...
f	,, Sheet ... ... ,,	2/3 to 2/6	...
n	German Silver Wire ... ... ,,	2/2	...
h	Gutta-percha, fine ... ... ,,	nom.	...
h	India-rubber, Para fine ... ... ,,	8¾d.	½d. dec.
i	Iron, Pig (Cleveland No. 3.) ... per ton	86/-	13/6 inc.
l	,, Wire, galv. No. 8. P.O. qual. ,,	£20	...
g	Lead, English pig ... ... ,,	£22 15s.	5/- dec.
g	Mercury ... ... per bot.	£23 to £23 5s.	5/- inc.
e	Mica (in original cases) small ... per lb.	3d. to 8/-	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,,	10/- to 20/- & up	...
p	Phosphor Bronze, plain castings ,,	1/3½	...
p	,, ,, drawn bars & rods ,,	1/5	...
p	,, ,, rolled strip & sheet ,,	1/3½	...
p	,, ,, wire... ... ... ,,	1/6	...
o	Platinum ... ... per oz.	£13 10s.	...
d	Silicium Bronze Wire ... ... per lb.	1/2	...
r	Steel, Magnet, in bars ... ... ,,	7½d.	...
g	Tin, Block (English) ... ... per ton	£189 10s. to £190 10s.	£13 15s. inc.
n	,, Wire, Nos. 1 to 16 ... ... per lb.	8/6	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Reporting on November 23rd, Messrs. James Forster & Co. stated that in spite of support from producers early in the week, lead prices collapsed on Wednesday and Thursday last week, but on Friday a recovery took place. Owing to declarations of considerable quantities of American and Mexican lead due shortly, the backwardation ruling last week gave way to a contango. A fair business was done with consumers at the lower level of prices, chiefly for early delivery, and the demand was easily met, as supplies at the moment are more than sufficient for current needs. Continental demand remains exceedingly slow, with little business passing. The general position of the metal is deteriorating, with a tendency for supplies to exceed demand, and had it not been for the support afforded during recent weeks by the Producers' Association, it is certain that lower prices would have been seen in the market.

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Lighting and Power Notes.

Ashford.—BULK SUPPLY.—At a special meeting of the Urban District Council held recently, the Electricity Committee reported upon the offer of the Kent Electric Power Co. for a bulk supply, but it was agreed that the Council should proceed with the negotiations with the Electricity Commissioners for the installation of a further engine at the works.

Aylesbury.—SPECIAL ORDER.—The Corporation is to apply to the Electricity Commissioners for a Special Order authorising it to extend its area of supply so as to include the parish of Brackenham in the rural district of Wycombe.

Bexhill.—PUBLIC LIGHTING.—The Corporation Electricity Committee has considered the improvement of the lighting of the parade and the parade shelters, and decided to inspect the present lighting system with a view to submitting a full report.

Biggar (Lanarkshire).—ELECTRICITY SUPPLY.—The Town Council is considering an offer from the Clyde Valley Electrical Power Co. to lay a transmission line from Lanark to Biggar for the purpose of supplying the burgh with electricity.

Bolton.—CHANGE-OVER.—The Corporation has given notice of its intention to apply to the Electricity Commissioners for consent to standardise the a.c. system of supply throughout its area of supply.

Bolivia.—HYDRO-ELECTRIC DEVELOPMENT.—The Government has granted permission to the Bolivian Power Company to acquire the water rights at the Zongo Falls, and to erect a hydro-electric plant developing 25,000 h.p. The company is also authorised to construct transmission lines to bring power to La Paz. Installation work is expected to take about twelve months.—*Reuter's Trade Service* (La Paz).

Builth Wells.—PURCHASE OF UNDERTAKING.—Builth Wells Electric Supply Co., Ltd., has been purchased by the Shropshire, Worcestershire, and Staffordshire Electric Power Co.

Canada.—ELECTRICAL DEVELOPMENTS.—According to *Power*, the annual report of the British Columbia Power Corporation, issued recently, forecasts an expenditure of $50,000,000 on power development within the next six years. This sum will be spent largely on development of Bridge River, Ruskin and Campbell River hydro-electric projects. The total capacity of Bridge River is estimated in the report as 750,000 h.p. In the Ruskin development the ultimate capacity is estimated at 188,000 h.p., and will cost $20,000,000. About 47,000 h.p. will be brought into service in about a year.

HYDRO-ELECTRIC SCHEME.—The general contract of the Powell River Company for the development of 18,000 h.p. on the Lois River has been awarded to Stuart, Cameron & Co., Vancouver. The cost of the entire scheme is estimated at $6,000,000.

Continental.—PORTUGAL.—As a protest against an increase of 20 per cent. in the cost of electricity, most shops in Lisbon for the last month have not illuminated their windows at night, while others have used candles and oil lamps after dark. As a result of this boycott, a meeting was held between representatives of the Gas and Electricity Company and representatives of trade and commerce, and an arrangement was reached whereby the company will allow a 50 per cent. reduction in charges to commercial houses for any consumption of electricity exceeding a certain minimum. The shopkeepers have now reverted to their usual lighting arrangements.—*Reuter.*

SWEDEN.—In a recent issue of the bi-weekly "Commerce Reports," published by the Swedish Board of Trade (Kommerskollegium), Mr. Viking Kaellströem gives an interesting summary of the production and consumption of electric power in Sweden during 1928. The report shows that the total production of electric power has increased from 1,449 million kWh in 1913 to 4,410 million kWh in 1928, so that during the past 15 years the total production has been more than trebled. During the last five years the increase was 48 per cent. The work of enlarging old plant or building new stations in hand on January 1st, 1929, represented a total capacity of about 145,000 h.p. Amongst the consumers of power during 1928 the big industries came first, with a total consumption of 2,270 million kWh, while for the small industries, farming, household, and lighting purposes the consumption was 490 million kWh. The aggregate gross income in Sweden from the sale of electric power during the past year was 126 million kronor (£7,000,000), as against 120 million kronor (£6,670,000) in 1927. Of this, 21.6 million kronor (£1,200,000) went to the Government power plants, 61.9 millions (£3,440,000) to municipal, and 42.5 millions (£2,350,000) to other plants. Sweden's total resources of water power, according to a recent estimate, amount to between 4 and 6 million h.p. Of this, about three million h.p. will probably be required and exploited during the next 50 years, and about 1,300,000 h.p. is at present fully ultilised.

FRANCE.—With the object of utilising the water power resources of the River Rhone, a company is being formed in Lyons with the title of La Compagnie Nationale du Rhone. The General Council of the Department of the Isère has resolved to take a large financial interest in the new undertaking.

ITALY.—According to a recent return, the installed capacity of hydro-electric generating stations in Italy increased during the twelve months ended July last from 2,602,000 kW to 2,878,000 kW. During the same period there was an increase in the capacity of steam, gas, and oil-operated stations from 577,000 to 655,000 kW.

Hereford.—TRANSFER OF UNDERTAKING OPPOSED.—According to the *Birmingham Post*, a campaign is being conducted by the Hereford Labour Party and Trades and Labour Council against the proposal of the City Council to transfer the municipal electricity undertaking to the Shropshire, Worcestershire, and Staffordshire Electric Power Company, which proposes to supply the greater part of electricity used in Herefordshire from its station at Stourport. A petition to the Electricity Commissioners is being organised, opposing the transfer on the ground that (*a*) the Hereford electricity works can be made to pay under improved management; (*b*) a public inquiry into the proposed transfer should be held; (*c*) the City Council has not consulted the citizens; (*d*) the transference may result in the price of electricity being increased; (*e*) members of the City Council may be interested financially in the transfer; and (*f*) they have special information which could be given at a public inquiry.

Holywell.—ELECTRICITY SUPPLY EXTENSIONS.—The Electricity Distribution of North Wales & District, Ltd., has notified the Rural District Council of its intention to give a supply of electricity to the villages of Halkyn and Pentre Halkyn.

India.—CALCUTTA.—As a result of the rapid growth in the demand for electrical energy on the Howrah side of the Hooghly river, the Calcutta Electric Supply Corporation, Ltd., has been faced with the question of choosing between erecting a new generating station on the right bank of the river, or of devising some secure means of carrying cables across the river from the Southern power station. In a notice issued to shareholders last week the Corporation states that it is proposed to construct a tunnel under the river to take all necessary cables across to the right bank. This tunnel, which is the first of its kind in the East, will be at a depth of 93 ft. below the surface. Its length will be nearly 600 yards and its internal diameter 6 ft. It is expected that the work will be completed by midsummer, 1931.

Irish Free State.—DUNDALK.—The proposal that with the coming of the Shannon electricity scheme the Dundalk power station, which has been operating under municipal control for the past 18 years, should be abolished, is being strongly opposed by the Urban District Council. A scheme has been submitted to the Electricity Supply Board providing for the conversion of the Shannon supply into d.c. for the supply of the town and district at a cost of £20,000. The Council, in approving the schemes prepared by its engineer, asks the Electricity Board to inquire whether expediency does not outweigh considerations of strict economy in this particular case.

Lathom and Burscough.—SPECIAL ORDER.—The Urban District Council has decided to make application to the Electricity Commissioners for powers to supply electricity in the district of Lathom and Burscough.

London.—STOKE NEWINGTON.—Experimental high candle-power electric and gas lamps of various types, with and without refractors, have been erected in Seven Sisters Road between Manor House and Amhurst Park. The Borough Council Highways Committee has given careful consideration to these and to the comparative cost and efficiency of gas and electricity for street lighting. A report has been prepared by the borough engineer, embodying a scheme recommended by him for re-lighting these roads by means of 500-watt electric or 900-c.p. gas lamps, spaced at intervals of 180 ft. After full consideration of the matter the Committee has come to the conclusion that it will be advisable, and in the interests of efficiency, if gas and electric lamps as described above are erected alternately in these main thoroughfares.

The Borough Council Electricity Committee is to extend mains at cost of £541 and install free wiring at a cost of £829.

HAMMERSMITH.—The Borough Council has received sanction to the borrowing of £9,967 for mains extensions.

WANDSWORTH.—The Borough Council Highways Committee is to improve street lighting in Clapham at a cost of £1,143.

ST. PANCRAS.—The Borough Council Electricity and Public Lighting Committee recommends that the standing charge for electricity under the "One-meter-system" be reduced from £16 to £12 per kW.

STREET LIGHTING.—The L.C.C. Highways Committee recommends the approval of the standard price of 2d. per kWh fixed by the South Metropolitan Electric Light and Power Co., Ltd., for street lighting.

New Zealand.—HYDRO-ELECTRIC SCHEME.—Mr. H. P. Gibbs, a British hydro-electric engineer, representing a nitrogen-producing organisation which holds an option on a large power scheme at Lake Manapouri, near the fiords of the south-west coast, has returned to Dunedin after investigating the proposal. It is understood that the scheme involves the construction of six miles of tunnelling in order to obtain power sufficient to generate 250,000 h.p. The total cost of the scheme, it is understood, would amount to £6,000,000.—*Reuter* (Wellington).

HYDRO-ELECTRIC SCHEME INAUGURATED.—The Lake Waikaremoana hydro-electric scheme, which is the last big link in the North Island hydro-electric system, was officially opened on November 20th by the Governor-General, Sir Charles Fergusson.—*Reuter* (Wellington).

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Preston.—LOAN.—The Corporation Electricity Committee has recommended that application be made for sanction to a loan of £57,079, to be spent on the river wall, buildings and plant. The sum of £8,634 is required for the transmission line and sub-station for Blackburn, and £12,306 for the first part of the Blackpool line.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

LONDON.—*Stepney.*—The secondary charge for lighting and domestic supplies: from 1d. to ½d. per kWh. Public lighting: from 1d. to ½d. per kWh, with no discount.

WELWYN GARDEN CITY.—Two-part tariff "unit" winter charge: first 40 kWh, per quarter, 3d. per kWh, and 1d. per kWh for all further energy consumed. Two-part tariff "unit" summer charge: first 20 kWh per quarter, 3d. per kWh, next 180 kWh 1d., above 200 kWh, ½d. The two-part tariff fixed charges have also been reduced. Lighting flat rate: from 10d. to 8d. per kWh. Flat rate prepayment consumers: a refund of 1½d. in the 1s.

Southend-on-Sea.—BULK SUPPLY.—The Electricity Commissioners have approved the agreement between the Corporation and the County of London Electric Supply Co., Ltd., for a supply of electricity in bulk.

Stirling.—NEW ELECTRICITY CHARGES.—The Town Council has adopted the following scale of charges for general consumers: First 3,000 kWh, 4d. per kWh; second 3,000 kWh, 3½d.; third 3,000 kWh, 3d.; all over 9,000 kWh, 2d. per kWh.

United States.—ELECTRICAL DEVELOPMENTS.—The Washington Electric Company, Seattle, Wash., a subsidiary of the Puget Sound Power & Light Company, Seattle, has been granted a licence by the Federal Water Power Commission for a hydro-electric scheme at Rock Island, on the Columbia River, near Wenatchee, with an initial capacity of 60,000 kW. This licence, says *Power*, enables the company to proceed with a scheme that will cost from $10,000,000 to $12,000,000 for the first unit, and will ultimately have a capacity of 180,000 kW. The company hopes to complete the first unit by 1933.

The Georgia Power Company has completed preliminary plans and hopes to start work immediately on a new 60,000-h.p. hydro-electric development on the Oconee river at Furman Shoals, four miles north of Milledgeville, Ga.

West Lancashire.—ELECTRICITY SCHEME.—The Rural District Council is applying for sanction to a loan of £22,625 in connection with future developments in the electricity scheme for the parishes of Aughton, Maghull and Lydiate.

Worcester.—OVERHEAD LINE.—The City Council has authorised the construction of an overhead line connection to the power line at Kenswick of the Shropshire, Worcestershire and Staffordshire Power Co. The cost of this connecting line is estimated at £20,730, of which it is expected the company will contribute approximately one half.

Tramway and Railway Notes.

Australia.—SYDNEY.—Steady progress is being made with Sydney's underground electric railway system, which is to be opened for traffic at the same time as the Sydney Harbour bridge. The section from the Central Station to St. James' Square, which has been in operation for some time, is now being extended to Circular Quay and will link up with the sections between the south side of the Harbour Bridge and Central Station. The greater part of the tunnelling work over the whole route has been completed, and concreting is well advanced. The station details at the Town Hall and Wynyard Square are well in hand, but work on those at Circular Quay has been in suspense pending the choice by the Government of rival designs and sites. This choice has now been practically agreed upon, and the work will be proceeded with almost immediately. The system will eventually be connected with a railway service to the eastern suburbs, the prospective junction being at St. James' Square. Preliminary investigations on the proposed route of this line are now in progress.—*Reuter* (Sydney).

Barnsley.—PROPOSED TRAMWAY ABANDONMENT.—The Yorkshire Traction Co., Ltd., is promoting a Bill in Parliament for powers to abandon the tramway system and substitute motor-buses.

Continental.—FRANCE.—Plans were drawn up some time ago for the electrification of the P.L.M. railway, but as the cost will be very considerable the programme is consequently to be carried out section by section. The work of electrifying the eighty-four miles between Culoz and Modane is to be carried out shortly. Power will be provided by seven power stations which will utilise the water power from the Arly, the Doron and the Beaufort rivers. Only a small proportion of the energy generated at these stations will be used by the railway, the rest being distributed over the surrounding district. The third rail system will be employed mainly, overhead traction being resorted to only in the larger stations.—*Reuter* (Paris).

RUSSIA.—The work of electrification having been completed, electric trains are now being run on the local railway between Moscow and Mytischtsche, a distance of about 11 miles.

Dearne Valley.—RAILLESS CARS.—As the result of the decision of the Doncaster and Barnsley local authorities to abandon the tramways in favour of railless cars, the Dearne Valley Light Railways has decided to promote a Bill in Parliament to enable it to substitute railless cars for its tramway system, which was completed about ten years ago at a cost of £250,000.

India.—BOMBAY.—The Bombay Electric Supply and Tramways Co., Ltd., is to extend the tramway system along Sudenham Road from its junction with Bhendi Bazar to the junction of Palton Hornby Roads.

Japan.—RAILWAY VOLTAGE STANDARDISATION.—The I.G.R. is considering the standardisation of the voltage used on the Japanese electric railways at either 750 or 1,500 volts.

Manchester.—UNDERGROUND RAILWAY SCHEME.—The Corporation Underground Railways Committee is to ask the City Council at its January meeting for permission to apply to the Government for a grant in respect of the city's tube railway scheme, the cost of which is estimated at £11,000,000.

United States.—RAILWAY ELECTRIFICATION.—One hundred and fifty electric locomotives, more powerful than any yet constructed and of such speed that the scheduled time between the line of industrial cities in the north-east will be reduced by 20 per cent. or more, are to be ordered by the Pennsylvania Railroad as part of a comprehensive electrification scheme soon to be put into operation. The New York correspondent of *The Times* states that these locomotives, the cost of which is estimated at $16,000,000 (£3,200,000), will be used in pairs, giving 6,000 h.p. and a maximum speed of more than 90 miles an hour. They will serve the line from New York through Trenton, Philadelphia, and Baltimore to Washington, and will accomplish the journey from New York to Washington in four hours, at an average speed of nearly 60 m.p.h. The new service is expected to eliminate automobile competition and also the necessity of the railroad extending its air service operations between New York and Washington in the near future.

Telegraph and Telephone Notes.

Brazil.—SHORT-WAVE RADIO STATIONS.—The Companhia Auxiliar Radio Emissora do Brazil will shortly commence work on the installation of radio-telegraph stations at Fernando-de-Noronha, destined to become the most important air-port in Brazil; Natal, Recifé (Pernambuco), Maceao, Bahia, Caracellas, Victoria, Rio de Janeiro, Santos, Florianopolis, Pelotas, and Puerto Alegre. It is also proposed to install short-wave stations at a number of points not already provided with radio-telegraph stations. The Minister of Transport and Communication has expressed his approval of the entire plan.—*Reuter's Trade Service* (Rio de Janeiro).

AUTOMATIC TELEPHONY. — The Companhia Mineira de Electricidade has obtained a concession for a system of automatic telephony at Juiz de Fora (population 120,000), the third most important manufacturing centre in Brazil. A contract has also been concluded between that company and the Swedish L. M. Ericsson Co. for most of the material, including apparatus for 1,500 city and 60 interurban equipments.—*Reuter's Trade Service* (Bello Horizonte).

Italy.—VATICAN CITY.—The Vatican City's telegraph office was opened to the public on November 25th, providing a direct service to and from the Pope's little dominion.

South Africa.—RADIO-TELEPHONY.—It is understood that recently experiments in wireless telephony have been carried out between the British and South African Post Offices. Great Britain has spoken to Pretoria with fairly satisfactory results, but Pretoria has not yet spoken to Great Britain.

The experiments are being made with short waves, and two-way communication has, of course, already been satisfactorily carried out with Australia.

The Telephone Service.—PROPOSAL FOR SEPARATE AUTHORITY.—At the instance of the Post and Telegraph and London Telephone Advisory Committee, the Council of the London Chamber of Commerce has decided to ask the Government to institute an inquiry into the advisability of establishing an independent statutory authority to administer the internal telephone and telegraph services of the country. The Telephone Development Association favours such an inquiry, and is now considering the draft of a scheme designed to meet the special requirements of telephone administration in Great Britain. If, in the meantime, an official inquiry were undertaken by the Government, the Association would welcome the opportunity of putting forward its own recommendations.

SHIP-SHORE SERVICE.—The first telephone service on the Tyne linking up ships with the shore was opened on Novem-

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ber 22nd. Recently the Tyne Improvement Commission decided to install telephones at its seven staiths at Whitehill Point, North Shields, with extensions to the vessels lying at the loading berths.

Transatlantic Telegraphy.—Cable Interruptions.—The severe earthquake that shook the North-Eastern Atlantic coast on November 18th interfered considerably with the submarine telegraph cables. It has been reported that nearly half of the score or so of cable lines between this country and North America was broken by the upheaval of the ocean bed in the region of Nova Scotia, and several were apparently broken at more than one point. This is believed to be the first time in the history of the Atlantic cables that they have been injured by an earthquake. The Western Union Telegraph Company sent out two repair ships, the *Lord Kelvin* and the *Cyrus Field*, from Halifax, Nova Scotia. The company also chartered the *Dominia*, the largest cable-laying ship in the world, which is owned by the Telegraph Construction and Maintenance Company, of Greenwich. The Western Union Company maintains nine cables across the Atlantic, with a tenth which ends at the Azores, and three of the nine were broken.

The Commercial Cable Company sent out the *John W. Mackay*, one of the company's two repair ships, from Halifax, and the other was recalled from South America, through the Panama Canal. The company also commissioned the *Faraday*, of London, to co-operate in the work. Four out of the company's six cables between New York and Nova Scotia were damaged off the coast of Nova Scotia; and three of the broken cables extend across the Atlantic. Both the Imperial cables from North America were stated by Imperial and International Communications to have been out of action.

The mishap appears to have roughly halved the normal telegraph facilities, causing considerable delay to the cheaper services, but little to urgent messages. Communication was maintained by diverting traffic to the radio services and alternative cable routes.

From France it was reported that severe storms in the Atlantic off Brest broke the cable between Brest and Casablanca. The British cable ship *Telconia* went out on November 19th in an endeavour to repair the damage, but was obliged to put into Ushant, owing to the heavy seas.

Venezuela.—Wireless Telegraphy.—A message from Caracas says that it has been decided to add a number of new short-wave radio-telegraph stations to amplify the services at Caracas, Maracay, and Marquetia. Eventually the radio-telegraph service will be extended to many other points in Venezuela. It is stated that the revenue from radiograms during the past fiscal year (958,000 bolivars) was four times that of the previous year, and that the general expenses of the radio-telegraph service were covered more than twice over. —*Reuter's Trade Service.*

Radio Notes.

Algiers.—New Broadcasting Station.—The Governor-General of Algeria, North Africa, opened a high-power broadcasting station at Arba, in the neighbourhood of Algiers, on November 19th.—*Reuter's* (Algiers.)

Holland.—Relay Stations.—The Catholic Radio Society (K.R.O.) and the Netherlands Christian Radio Society (N.C.R.V.), founders and principal controllers of the Huizen station, have applied to the Minister of Waterstaat for permission to erect a number of local stations in various parts of the country for relaying the Huizen programmes, says *World-Radio*, which explains that it is proposed to make use of the "Gleichwellen" system of common waves.

The Broadcasting Union.—Recent Meeting.—The International Broadcasting Union, of which Vice-Admiral Carpendale, of the British Broadcasting Corporation, is president, held at Barcelona, Spain, last week, a series of meetings of its council and various commissions, which were attended not only by members of the Union, but also by a number of official delegates of the various European postal and telegraph administrations, the director of the Berne Bureau of the International Telegraph Union, a representative of the secretariat of the League of Nations, and by representatives of the International Red Cross and League of Red Cross Societies. According to *The Times*, the council adopted the report of the technical commission dealing with the application of the Prague, European Plan of wave-lengths, which recommends a more rigorous use of the means the Union has at its disposal for keeping stations strictly to their allotted wave-lengths, and some procedure for reducing interference due to faulty control of modulation. The Union will study, in association with postal and telegraph administrations, through the medium of the Berne Bureau, a number of technical problems which require examination before the next World Conference of the International Telegraph Union at Madrid in 1932. Other subjects dealt with were international exchanges of programmes through the medium of the new international telephone circuits, and a scheme for relays from Geneva during the annual assemblies of the League of Nations. Resolutions were also adopted for co-operation with the new official First Aid Union (Union Internationale des Secours).

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—Melbourne.—Posts and Telegraph Department. January 7th. Telephone hand sets. (B.X. 5823.)* Contact pressure testers. (B.X. 5821.)*

January 14th. Ringing motor-generator sets for automatic telephone exchanges. (B.X. 5839.)* Telephone indicators. (B.X. 5822.)*

January 28th. Induction coils and register plates. (B.X. 5899.)*

January 13th. State Electricity Commission of Victoria. 2,200-V switchgear and accessories. (B.X. 5827.)*

Belgium.—December 11th. Post and Telegraph authorities, La Salle Madeleine, Brussels. Supply and laying telephone cables between Mouscron, Wevelghem, and Dottignies, and between Ostend and La Panne. Particulars (Cahier des Charges Special No. 3452) for 18 francs.

Birmingham.—December 4th. Board of Guardians. Electrical work at Western House. Mr. C. P. Beech, Clerk to the Guardians, Union Offices, Edmund Street, Birmingham. (Deposit £2 2s.)

Cheadle and Gatley.—Electricity Department. December 10th. E.h.p. and m.p. cable extensions. Specifications (Contract No. 48) (£2 2s.) from Mr. R. W. Willis, electrical engineer and manager, 37, High Street, Cheadle, Cheshire.

Clydebank.—Town Council. Electric lighting installations in connection with the erection of 320 houses (deposit £1). Mr. J. W. Johnston, town clerk, Municipal Buildings, Clydebank.

Egypt.—Cairo.—December 28th. Ministry of Public Works. Electric generating and pumping sets for Mankabad Barracks. (B.X. 5842.)*

February 1st. Ministry of the Interior. Centrifugal well pump and direct coupled electric motor with piping and accessories. (A.X. 8811.)*

Hull.—December 19th. Electricity Department. Supply of electricity meters. (November 22nd.)

Irish Free State.—Dublin.—December 7th. Department of Industry and Commerce. New pumping plant, in connection with Shannon power development. Specifications (£1 1s.) from Chief Engineer, 88, Merrion Square, Dublin.

Waterford.—Town Council. December 2nd. Electric wiring installation at the town hall and municipal buildings. Specifications (deposit £2 2s.) from Messrs. McEntee and O'Kelly, consulting engineers, 23, Upper O'Connell Street, Dublin.

Kirkcaldy.—Fife.—December 18th. Education Authority. Electric and heating works, at additions to St. Agatha's R.C. School, Methil, and Bell-Baxter school, Cupar. Schedules (deposit £1 1s. each) from Mr. E. Sandilands, architect and master of works, Education Offices, Kirkcaldy.

London.—Stepney.—December 5th. Board of Guardians. Installation of wireless receiving apparatus at each of its three hospitals. The apparatus required will include 1,159 headphones and 24 loud-speakers. (November 15th.)

Central Electricity Board.—December 21st. Supply, delivery and erection of 132,000-V transformers for the Mid-East England Electricity Scheme, 1929. (November 22nd.)

January 6th. Supply, delivery, and erection of 132-kV overhead transmission lines (special crossings and high spans),

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for the North-West England and North Wales Electricity Scheme, 1928. (See this issue.)

WANDSWORTH.—December 11th. Union Guardians. Supply of 18 electric sterilisers. (See this issue).

Manchester.—December 13th. Electricity Committee. Electrically-propelled tower-ladder vehicles. (See this issue).

December 10th. Delivery and placing into position at the Barton power station of 12 single-phase feeder reactors, and the supply and placing into position in the Manchester area of 125, 250, 500, 750, 1,000 kVA 6,400-400 V 3-phase, oil-immersed, self-cooled transformers. (See this issue.)

December 17th. Supply and erection of one 6,600-V sheet-steel type transformer kiosk and switchgear. (See this issue.)

Millom.—December 20th. Urban District Council. E.h.p. and l.p. cables, pillar box, &c., and e.h.p. and l.p. switchgear, transformer, &c., for the Haverigg extension scheme.. (November 22nd.)

New Zealand.—WELLINGTON.—Post and Telegraph Department. January 13th. Four point jacks. (B.X. 5840.)*

January 16th. Telephone switchboard plug covers. (B.X. 5879.)*

Public Works Department. January 14th. Two air compressors and two electric motors. (A.X. 8784.)*

January 28th. Three 50-kW, oil-immersed, circuit breakers for Arapuni. (B.X. 5878.)*

Rochdale.—December 3rd. Town Council. Electric lighting and power installation for 104 houses, Spotland Estate.—Particulars from Borough Surveyor, Town Hall.

South Africa.—PRETORIA.—December 27th. Posts and Telegraph Department. Telegraph material. (A.X. 8734.)*

BLOEMFONTEIN.—January 10th. Electricity Supply Department. Automatic electric traffic signals. (B.X. 5887.)*

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Bexhill.—Electricity Committee. Recommended:—
Cable for six months.—Enfield Cable Works, Ltd.
Meters (£1,057).—Edison Swan Electric Co., Ltd.
Prepayment meters (£34).—Chamberlain & Hookham, Ltd.

Cape Town.—Electricity Committee. Recommended:—
Cable.—Siemens Bros. & Co., Ltd. (£33,296); British General Electric Co., Ltd. (£1,676); A.E.G. Engineering Co. (S.A.), Ltd. (£5,249); British Insulated Cables, Ltd. (£902).

Chopwell.—Co. DURHAM.
Wiring in screwed conduit 635 houses, with street mains, house mains, &c.—R. W. Leek & Co.

Croydon.—Electricity Committee. Recommended:—
Electrical work in connection with linking switch-rooms with new switch-house (£1,108.)—English Electric Co., Ltd.
Switchroom equipment (£19,015).—Metropolitan-Vickers Electrical Co., Ltd.
Works auxiliary switchboard (£1,728).—Ferguson Pailin, Ltd. (Recommended.)

Glasgow.—Transport Committee.
Installation of the boiler plant in connection with the reconditioning scheme at Pinkston power station, six boilers (£90,327).—John Thompson (Water Tube Boilers), Ltd. (Recommended.)

Government Contracts.—The following Government contracts were placed during October, 1929:—

ADMIRALTY CONTRACT AND PURCHASE DEPARTMENT.
Motor-alternators.—W. Mackie & Co., Ltd.
Batteries.—Ever-Ready Co., Ltd.
Battery gear.—Tudor Accumulator Co., Ltd.
Rotary blowers.—Reavell & Co., Ltd.
Distributing boards.—L. Weekes (Luton), Ltd.; Park Royal Engineering Co., Ltd.; Veritys, Ltd.; McGeoch & Co., Ltd.
Electric cable.—Croydon Cable Works, Ltd.
W./t. coils.—Marconi's Wireless Telegraph Co., Ltd.; H. W. Sullivan, Ltd.
W./t. condensers.—Dubilier Condenser Co. (1925), Ltd.
Electrical equipment for cranes.—Wharton Crane and Hoist Co., Ltd.
Electric hot cupboards.—Credenda Conduits Co., Ltd.
Reversing motor-generators and boosters.—Haslam and Newton, Ltd.; Small Electric Motors, Ltd.
Electrical indicators.—Dobbie, McInnes & Clyde, Ltd.
Electric light installation.—G. E. Taylor & Co.
Electric lamps.—General Electric Co., Ltd.
W./t. panels.—H. W. Sullivan, Ltd.
Copper bars and bronze sheets, bars, &c.—T. Bolton and Sons, Ltd.; Birmingham Battery & Metal Co., Ltd.; Bull's Metal & Melloid Co., Ltd.; Delta Metal Co., Ltd.; Elliott's Metal Co., Ltd.; McKechnie Bros., Ltd.; P. H. Muntz & Co., Ltd.; Manganese Bronze & Brass Co., Ltd.; W. Roberts & Co.; Garston (1928), Ltd.
Starters and resistances.—Watford Electric & Manufacturing Co., Ltd.; Rheostatic Co., Ltd.
W./t. transmitters.—Marconi's Wireless Telegraph Co., Ltd.; Gambrell Bros., Ltd.; H. W. Sullivan, Ltd.
Tuners, amplifiers, receivers, &c.—Radio Instruments, Ltd.; The Plessey Co., Ltd.; Marconi's Wireless Telegraph Co., Ltd.; H. W. Sullivan, Ltd.; Johnson and Phillips, Ltd.
Wireless valves.—Mullard Radio Valve Co., Ltd.
Enamelled copper wire.—British Insulated Cables, Ltd.; London Electric Wire Co. & Smiths, Ltd.

WAR OFFICE.
Electric lamps.—General Electric Co., Ltd.; Edison Swan Electric Co., Ltd.
Generating sets.—Douglas Motors, Ltd.
W./t. valves.—General Electric Co., Ltd.
Electric lighting installations.—Holywood: W. Coates and Sons, Ltd.; Dunbar Barracks: Grindlay Ross & Co., Ltd.

AIR MINISTRY.
Battery charging panels.—Harland Engineering Co., Ltd.
Diesel generating set (Calafrana).—Mirrlees, Bickerton and Day, Ltd.
Cockpit lamps.—Johnson & Phillips, Ltd.
Receivers.—Johnson & Phillips, Ltd.
Transmitters and spares.—Johnson & Phillips, Ltd.
Wavemeters.—H. W. Sullivan, Ltd.

POST OFFICE.
Telegraph apparatus.—Creed & Co., Ltd.
Telephone apparatus.—Automatic Telephone Manufacturing Co., Ltd.; Ericsson Telephones, Ltd.; International Electric Co., Ltd.; B. W. Johnson; Phœnix Telephone & Electric Works, Ltd.; Siemens Bros. and Co., Ltd.; Standard Telephones & Cables, Ltd.
Protective apparatus.—Automatic Telephone Manufacturing Co., Ltd.; Phœnix Telephone & Electric Works, Ltd.
Wireless apparatus.—Standard Telephones & Cables, Ltd.
Cable (various).—B. I. Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; Enfield Cable Works, Ltd.; W. T. Glover & Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones and Cables, Ltd.; Union Cable Co., Ltd.
Joint box castings.—General Foundry & Engineering Co., Ltd.; Grahamston Iron Co., Ltd.; United Steel Companies, Ltd. (Thomas Butlin & Co. Branch).
Secondary cells.—D.P. Battery Co., Ltd.
Loading coils.—General Electric Co., Ltd.
Moving-coil condensers.—General Electric Co., Ltd.
Dynamotors.—W. Jones & Co.
Earpieces.—North British Rubber Co., Ltd.
Electric light fittings.—Stevens & Williams, Ltd.
Electric handlamps.—Veritys, Ltd.
Wood troughing.—Armstrong, Addison & Co., Ltd.
Electric trucks.—Greenwood & Batley, Ltd.
Bronze wire.—British Insulated Cables, Ltd.
Flameproof wire.—Enfield Cable Works, Ltd.; Macintosh Cable Co., Ltd.; Reliance Electrical Wire Co., Ltd.
Air compressors.—Grimsby H.P.O.: Lacy-Hulbert and Co., Ltd.
Batteries (Synthetic, Ammonia and Nitrates automatic P.B.X.—Billingham): Premier Accumulator Co., Ltd.
Manufacture, supply, laying and jointing cable.—Anglo-Belgian, 1930, land and submarine: Siemens Bros. and Co., Ltd.; Bradford-Huddersfield: W. T. Henley's Telegraph Works Co., Ltd.
Electrical equipment.—Acorn Telephone Exchange W. sub-station: A. Reyrolle & Co., Ltd.
Telephone exchange equipment.—Greenwich, Gerrard, Harrow, Wanstead, Kingston-on-Thames, and Regent: Automatic Telephone Manufacturing Co., Ltd. Merrylee (Glasgow): General Electric Co., Ltd. Sub-contractors: Crompton Parkinson, Ltd., for motor-generators and ringing machines; D.P. Battery Co., Ltd., for batteries. Morecambe: Standard Telephones and Cables, Ltd. Sub-contractors: Electric Construction Co., Ltd., for motor-generator; Crompton Parkinson, Ltd., for ringing machines; Chloride Electrical Storage Co., Ltd., for batteries.

CROWN AGENTS FOR THE COLONIES.
Cables.—Siemens Bros. & Co., Ltd.; Callender's Cable and Construction Co., Ltd.
Distribution line materials.—Bullers, Ltd.
Electric lighting plant.—General Electric Co., Ltd.
Lightning guards.—Muirhead & Co., Ltd.
Spares for Lux cells.—Chloride Electrical Storage Co., Ltd.
Static transformers.—Brush Electrical Engineering Co., Ltd.
Switchboard modifications.—British Thomson-Houston Co., Ltd.
Switchgear.—Electric Control, Ltd.
Telephone apparatus.—Standard Telephones & Cables, Ltd.
Telephones.—Ericsson Telephones, Ltd.
Wireless apparatus.—Marconi's Wireless Telegraph Co., Ltd.

H.M. OFFICE OF WORKS.
Steam generating set, &c.—Greenwood & Batley, Ltd.

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Grimsby.—Corporation. Accepted:—
L.p. cables for 12 months.—Metropolitan Electric Cable and Construction Co., Ltd.

Irish Free State.—DUBLIN.—The following is a list of contracts placed by the Controller of Stores, Department of Posts and Telegraphs, during October, 1929:—
Batteries.—Edison Swan Electric Co., Ltd.
Bells (telephones).—Ericsson Telephones, Ltd.
Insulators.—Geerz Bros. and Kellie (Ireland), Ltd.
Poles.—McCartan Bros.; T. and C. Martin, Ltd.; Eustace and Co., Ltd.
Transmitters.—Ericsson Telephones, Ltd.
Wire (copper).—E. and E. Kaye, Ltd.
Wire (flameproof).—F. Routledge.
Valves (radio).—Standard Telephones & Cables, Ltd.

London.—STEPNEY.—Electricity Supply Committee. Accepted:—
Twenty-two circuit breakers (£107).—Whipp & Bourne.

Upton-on-Severn.—Rural Council. Accepted:—
Installing electric light at Council houses (£6 3s. each) for parlour type, and (£4 12s. each) for non-parlour type.—Mr. Addyman, Worcester.

Forthcoming Events.

Cardiff Engineering Exhibition.—November 27th to December 7th. Drill Hall, Cardiff.

Electrical Power Engineers' Association (London Central Section).—Friday, November 29th. Slater's Restaurant, High Holborn, W.C. Annual dinner.

Electrical Association for Women (Bristol and District Branch).—Friday, November 29th. Fortt's Restaurant, Bristol, 8 p.m.—1 p.m. Whist drive and dance.

Institution of Mechanical Engineers.—Friday, November 29th. Institution, Storey's Gate, S.W. Debate on "The Registration of Reliable Tests of Power Plant Machinery." Opened by Mr. R. H. Parsons.

Junior Institution of Engineers.—Friday, November 29th. 39, Victoria Street, S.W. 7.30 p.m. "Modern Welding Systems and Applications." Mr. W. C. Freeman.

Institute of Marine Engineers.—Friday, November 29th. Hotel Victoria, Northumberland Avenue, W.C.2. 7 p.m. Annual conversazione.

Association of Supervising Electrical Engineers.—Tuesday, December 3rd. Magnet House, Kingsway, W.C., 7.15 p.m. "Recent Development in Lighting Accessories, with Special Reference to the Increasing Use of Insulated Material in place of Metal." Mr. F. G. France.

Television Society.—Tuesday, December 3rd. Engineers' Club, W. 8 p.m. "Television: Some Suggested Schemes." Mr. E. G. Lewin.

Edinburgh Electrical Society.—Wednesday, December 4th. 16, Royal Terrace, Edinburgh. "Static Condensers." Mr. H. Ferguson.

British Institute of Radiology (incorporated with the Röntgen Society).—December 4th, 5th and 6th. Exhibition and special meetings.

Batti-Wallahs' Society.—Thursday, December 5th. Hotel Cecil, Strand, W.C. 12.30 for 1 p.m. Luncheon. Address by Mr. V. Watlington.

Electrical Society of Glasgow.—Thursday, December 5th. Visit to Royal Technical College, Glasgow, Electrical Engineering Department.

Institution of Electrical Engineers.—Thursday, December 5th. Institution, London, W.C. 6 p.m. "Surges and Overvoltage Phenomena on Transmission Lines due to Lightning and Switching Disturbances." Dr. H. Norinder.

(Meter and Instrument Section).—Friday, December 6th. Institution, London, W.C. 7 p.m. "Alternating-current Potentiometers and their Applications." Dr. C. V. Drysdale.

(Wireless Section).—Wednesday, December 4th. Institution. 6 p.m. "Naval Wireless Telegraphy Communications." Mr. G. Shearing and Capt. J. W. S. Dorling, R.N.

(North-Eastern Centre).—Tuesday, December 3rd, Annual dinner.

(Scottish Centre).—Tuesday, December 3rd. North British Station Hotel, Edinburgh. 7 p.m. Informal meeting. "Engineering from the Cape to Kenya." Prof. Baily.

(South Midland Centre).—Monday, December 2nd. University, Birmingham. 7 p.m. "The Modern Use of Pulverised Fuel in Power Stations." Mr. R. A. Chattock.

(East Midland Sub-Centre).—Wednesday, December 4th. Technical College, Derby. 6.45 p.m. "Electric Traction." Lieut.-Col. H. E. O'Brien.

(Scottish Students' Section).—Wednesday, December 4th. Glasgow. Ordinary meeting.

(North-Eastern Centre, Students' Section).—Friday, December 6th. Armstrong College, Newcastle-on-Tyne. Ordinary meeting.

(North-Western Students' Section).—Tuesday, December 3rd. Engineers' Club, Manchester. 7.15 p.m. "Overhead Line Work." Mr. F. J. R. Baldwin.

West Wales (Swansea) Sub-Centre.—Friday, November 29th. Corporation Showrooms, Swansea. 6 p.m. "Paris and the Pyrenees: Notes on some of the Technical Features of the I.E.E. 1929 visit." Mr. R. Borlase Matthews.

(North Midland Students' Section).—Tuesday, December 3rd. Hotel Metropole, Leeds, 7.20 p.m. "The Oil Circuit-Breaker." Mr. C. S. T. Paul.

Nottingham Society of Engineers.—Friday, December 6th. Annual dinner.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of makers of the following:—

Foot-warming apparatus for chiropodists' use. It is heated by ordinary wire elements of about 200 watts capacity, and the temperature obtained (by thermometer, which is visible from the outside of the box) is about 250 F.

Notes.

The New Health Exhibition.

During the short period of its existence the New Health Society has conferred considerable benefit upon the nation by its quietly persistent crusade for the observance of the few sane and simple rules of life that make all the difference between good and indifferent health. At the second of the annual exhibitions held under the auspices of the Society (New Horticultural Hall, Westminster, November 15th to 22nd) one of the largest displays was that of the German Health Society, including what has been called "The Transparent Man," a really interesting and instructive series of transparencies of the body prepared in a novel manner to show the organs and their functions, displayed in a way similar to X-ray photograph viewing benches with light beneath. Amongst the wax models were some illustrating burns sustained from electric currents. Other exhibitors included:—

C.C.A. (Vacuum Cleaners), Ltd., cleaners and floor polishers, including a combination model that sweeps, cleans, and polishes at the same time, demonstrated to show the removal of dirt from the floor beneath (and drawn through) a carpet.

Dowsing Radiant Heat Co., Ltd., light and heat apparatus for medical treatment, bed-warmers, sterilisers, vibrators, water heaters, high-frequency machines, &c.

Edison Swan Electric Co., Ltd., electric refrigerators.

General Acoustics, Ltd., electrical and other aids for the deaf.

Health Devices, Ltd., motor-driven vibrating exerciser and reducer.

Bedington, Liddiatt & Co., Ltd., "Savage" motor-driven exerciser.

Tellus Super Vacuum Cleaner, Ltd., a machine that dispenses with a dust bag in favour of a steel container; moreover, it can be used as a blower and also for spraying liquids, such as disinfectants, for lacquering furniture, garden spraying, &c.

Appointments Vacant.

Meter repairer for the City of Peterborough Electricity Department. Plumber-jointer for the Borough of Nelson Electricity Department. Consumers' engineer (£363) for the Wolverhampton Corporation Electricity Department. Financial assistant (£700) for the Municipality of Singapore Electricity Department. Assistant workshops superintendent for the Government of the Gold Coast. Assistant mains engineers, junior mains assistant, and junior assistant for mains drawing office for the Northampton Electric Light and Power Co., Ltd. Assistant mains engineer for Aden (Arabia) Electricity Department. Chief lecturer in the electrical engineering section of the engineering department of Halifax Municipal Technical College. Electrical engineer for New Mill Urban District Council. (See our advertisement pages to-day.)

A.S.E.E. Dinner and Dance.

The whist drive, dinner and dance held by the Association of Supervising Electrical Engineers at "Ye Mecca" Restaurant, Ludgate Hill, E.C., on November 16th, was an outstanding

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success; over 240 members and friends participated. The chairman of the Association, Mr. B. C. Garman, presided at the dinner, and referred with regret to the absence of Mr. S. B. Donkin, the president. Mr. F. W. Smith proposed the toast of "The Ladies," and Mrs. B. C. Garman replied. The M.C. for the whist drive was Mr. E. E. Gammon, and the M.C.'s for the dance were Messrs. E. L. Eastell and F. W. Smith. The winners of the whist drive prizes were as follows:—Ladies': 1st, Mrs. N. Young; 2nd, Mrs. E. R. Carter; and "booby," Miss P. Wray. Gents': 1st, Mr. E. D. Smith; 2nd, Mr. C. Norriss; and "booby," Mr. C. H. Taylor. Music was provided by the Connaught Dance Band, and the spot-lights, which added to the general success of the function, were loaned through the good offices of Mr. L. E. Buckell.

Educational.

The annual report for the Royal Technical College, Glasgow, for the 1928-29 session, shows that the total enrolments in electrical engineering for the day and evening classes was 756. The total student-hours for the same subject was 26,446.

Mishap at Nechells.

As was briefly reported last week, about midnight on Tuesday, November 19th, an explosion, which caused some alarm, took place at the Prince's power station, Nechells, of the Birmingham Corporation. Immediately afterwards light and power failed in several parts of the city, and also in some areas outside, including Sutton Coldfield, which draws power from Birmingham; certain works at which night shifts were engaged had their power and light cut off for a time. It was officially reported that the cause of the trouble was the bursting of a 33-kV transformer; the oil burst into flame, and had the transformer house been within the station instead of being isolated, the damage might have been greater. Happily, no workers were in the vicinity, so that the trouble was practically confined to the destruction of the transformer, which cost £6,000. Owing to the danger, the station was at once closed down, but the recent inauguration of the Hams Hall station enabled the supply to be restored fairly quickly, so far as the main night users were concerned. This is the first instance in the Midlands in which full recourse had to be had to an alternative supply, and the change-over was facilitated by the fact that the load at the time of the occurrence was light. The Summer Lane station was also requisitioned, and within a few hours of the occurrence three of the turbo-alternators at Nechells had been restored to service, and shortly afterwards the whole of the seven machines were in commission again.

Battersea Power Station.

The Ministry of Transport issued, last Tuesday night, as a white paper (Stationery Office, Cmd. 3,442, price 6d.) the interim report of the committee appointed to consider the question of sulphur fumes in connection with the proposed station at Battersea.

Fatality.

An inquest was held at Swansea, on November 20th, on Hetty Gorman (16), who received a fatal electric shock on November 11th when closing the gate of her garden. It was stated that a wire fence divided the houses, and the theory was that a worn flexible cable running from a neighbour's workshop at the bottom of his garden to his house was in contact with the wire fence, the result was that the current passed up one stay and down another of an aerial pole, and then along the fence again to Gorman's garden gate, which was kept closed by a wire loop. A formal verdict was returned.

The Electrical Association for Women.

On November 14th a successful social afternoon was held by the Electrical Association for Women at 46, Kensington Court, W.8, and an interesting talk was given on the electrical appliances in the model electric kitchen by Miss Norvick.

Within the last few weeks four new branches of the Association have been formed: East Devon—President, Mrs. Phillips; Joint Hon. Secretaries, Miss Wilson at Exeter and Miss Binney at Torquay. The Hartlepools & District—President, Lady Gray; Hon. Secretary, Mrs. J. H. Parker. Edinburgh & District—President, Viscountess Elibank; Vice-President, Miss M. G. Cowan; Hon. Secretary, Miss M. McNicoll. Plymouth—President, Viscountess Astor, M.P.; Joint Hon. Secretaries, Mrs. Goodall and Miss Hollest.

Mr. F. Forrest (Birmingham Electric Supply Department) contributed a paper (which was read by Mr. W. Lawson, in his absence) dealing with his American tour, before the Birmingham and Midland Branch of the Electrical Association for Women, on Wednesday last. Mr. Forrest attributes the great use of electricity in America—in spite of high gas consumption—to more extreme climatic conditions (compared with this country); the difference in the conditions under which the majority of the people lived; the greater use of electricity in factories; low tariffs framed to stimulate long-hour use; low cost of lamps and other apparatus; and a very strong selling organisation. In America the cost of electricity was about 1.15d. per unit, and in this country it was about the same, but salaries being higher in America the percentage of income spent on an equivalent supply of electricity was much less than here. In America, too, the "step-rate" gave a diminishing average price, according to quantity. An ordinary 40-watt lamp, which cost 2s. 4d. here, could be purchased anywhere in the States for 11d.

How to work under electric light without eye strain was the principal topic of a lecture given by Mr. T. Catten, of the Electric Lamp Manufacturers' Association, to members of the newly-formed Torquay branch of the Electrical Association for Women on November 19th. Mr. Catten explained how the diffused light shed by the opal bulb threw no shadows and imposed no strain on the eyes. Mr. J. Taylor and Miss M. M. Partridge, B.Sc., A.M.I.E., of Exeter, spoke of the excellence of the Association's aims.

I.E.E. North-Western Centre Dinner.

The annual dinner of the North-Western Centre of the Institution of Electrical Engineers was held on November 19th at the Midland Hotel, Manchester, and was attended by 270 members and guests. Mr. T. E. Herbert, chairman of the Centre, presided.

After the toast of "The King, Duke of Lancaster" had been honoured, Dr. H. Levinstein (chairman, Society of Chemical Industry) proposed "The Cities and Trade of Manchester and Salford." He said the two cities formed a very important centre of the electrical industry. In that respect they were absolutely modern and up-to-date.

Responding to the toast, Mr. Warbreck Howell (town clerk of Manchester) said the electrical industry was well organised and attracted the best types of young men. There was scope for ingenuity in improving methods of distribution. He hoped the cost to the consumer would be thereby reduced, so that it would be possible to bring into the homes of the poorer classes of the community the benefits and advantages which electricity offered in cleanliness, convenience, and the saving of labour.

The Rt. Hon. Lord Colwyn, proposing the toast of "The Institution of Electrical Engineers," said that the electrical industry, like other industries, was concerned with the great problems which the country had now to face—taxation, unemployment, and the development of bureaucracy. There were in the ranks of the electrical industry young men equipped with brain power and admirable qualities of mind, who ought to play their part in arriving at a solution of the problems. Especially he warned them not to seek to get rich by speculation. That did neither service to the country nor honour to themselves, but honest work would bring untold blessings.

Col. Sir T. F. Purves, O.B.E. (president of the Institution) said it had been his privilege to address the members of the North-Western Centre through the medium of the microphone and the loud-speaker, his presidential address having been relayed from London, but it was more satisfactory to meet them face to face. Manchester was honourably associated with the industry, art, science, and thought of England. In the same way the North-Western Centre was associated with the good work which the Institution carried on. The brains of the Institution could not be localised and concentrated in London; they were distributed throughout the whole of the organisation, whose life and usefulness depended upon the Centres. Each Centre had its individual life, and power to act independently; but all could unite and bring their collective wisdom to bear upon the problems which presented themselves. It was necessary for headquarters to know the conditions which arose in various parts of the country and how they were tackled by the Centres. The latter must not take it amiss if sometimes the attitude of London seemed to them a little paternal. A little investigation and a little comprehension would clear away all difficulties.

The chairman proposed the toast of "Our Guests," which was replied to by Mr. E. F. Stowell. The last toast, "The Chairman," was given by Mr. J. Harcourt Williams.

Midland Electrical Engineers' Ball.

The Midland Electrical Engineers' Annual Ball took place at the Grand Hotel, Birmingham, on Friday, November 15th. About 450 persons sat down to supper. During the evening a presentation was made by Mr. W. H. Heaton, chairman of the Engineers' Ball Committee, to Mr. and Mrs. R. A. Chattock, on the occasion of Mr. Chattock's retirement from the city electrical engineership, and to show appreciation of his valuable services as president of the Engineers' Ball Committee from its inception. The gift took the form of an antique silver cream jug and sugar basin, together with an old oak linen chest. The whole of the proceedings, which were most enjoyable, reflected great credit on the arrangements made by the committee.

The New Abertillery Sub-station.

The new central sub-station of the Abertillery Urban District Council was officially inaugurated at Abertillery on Thursday last week by Mr. W. Beignor, chairman of the Council. The equipment consists of a 300-kVA Hackbridge transformer, the supply being taken from the Ebbw Vale Co., Ltd., at 10,000 volts, 3-phase, 50 cycles. The high-voltage equipment was supplied by Messrs. A. Reyrolle & Co., Ltd., and consists of one of their T.D.12 oil switch-fuses with oil-immersed isolating links. The supply is duplicated from the ring main, and special interlocking features are arranged so that it is impossible to get out of synchronism. The low-voltage distribution (460 V) is supplied from a board manufactured by the Electrical Construction Co., Ltd. The substation itself was erected under the supervision of Mr. Dawson Thomas, engineer and manager of the Abertillery Council's electricity department.

The high-pressure supply was switched on by Mr. Frank

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Hodges, J.P., member of the Central Electricity Board, who was presented with a specially mounted and inscribed operating rod by the manufacturers. Mr. James Hillier (chairman of the Electricity Committee) switched on the low-pressure gear, and was presented by the manufacturers with a silver inkstand.

Proposing the toast of "The Abertillery Urban District Council" at a subsequent dinner, Mr. Frank Hodges referred to the heart-breaking task which the Council and its officers had had to face during the last ten years, and he congratulated them on embarking on electrical development, when, from the point of view of local conditions, they ought to be in the candle stage. He also congratulated Mr. Dawson Thomas on his foresight in connection with the establishment of the sub-station.

The toast of the "Electricity Committee" was submitted by Mr. S. B. Haslam, chairman of the Western Centre of the Institution of Electrical Engineers, and Councillor James Hillier responded.

E.P.E.A. Annual Dinner.

The eleventh annual dinner of the South Coast Section of the Electrical Power Engineers' Association was held at the Masonic Hall, Albion Place, Southampton, on November 16th. The gathering was presided over by Mr. J. B. B. Howat, chairman of the Section for the second year in succession.

Following the loyal toast the health of the Association was proposed by Mr. P. G. Sparry (lecturer in electrotechnics, University College, Southampton), who spoke of the good work done by the Association in gaining recognition of the worth and merits of the electrical engineer. The assistance rendered to the staff engineer in making him competent to deal with any problems he might encounter also played a most important part in the work of the Association.

Mr. T. D. Martin, president of the Association, who responded to the toast, stated that the Association had been occupied during the last year in revising the schedule of salaries and conditions. On comparing the returns of the electrical undertakings in the country, it would be noticed that the undertakings which were in the soundest positions financially were those which applied the Association's salary schedule most rigorously. The fact that many undertakings were able to sell electricity at a price less than pre-war spoke well of the attention paid by the Association to the economic and scientific sides of the industry. Referring to the grid scheme, Mr. Martin said that there would be a considerable reduction in the number of power stations in operation. That would mean that many more men would be required on the distribution side and fewer and more highly-skilled men on the generating side. The Association should be prepared to meet these altered conditions.

Mr. Howat, in giving the toast of "The Visitors," said that the power station had not yet been invaded by the ladies, but much useful work was being done by them through the Electrical Association for Women in promoting the use of electricity. Replying to that toast the Mayor of Southampton paid tribute to the progress made by the Southampton Electricity Department, and added that electricity was one of the cheapest things in the town. Testimonials in the form of cheques were presented to Mr. Egan and Mr. Denne for their services to the section in their capacities of hon. secretary and hon. treasurer, respectively.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

The Hewittic Electric Co., Ltd., informs us that Mr. E. A. H. Bagnall is leaving on December 13th for an extensive tour of India on behalf of the company. Before he sails Mr. Bagnall will be pleased to meet any engineers who may be interested in the company's products for India, if they will communicate with the head office, Walton-on-Thames, Surrey.

The marriage took place on November 21st, of Mr. Charles Furness, borough electrical engineer and tramway manager, Blackpool, and Mrs. M. V. McCandlish. Mr. J. H. Farthing, of Bowden, Cheshire, was the best man. Later in the day Mr. and Mrs. Furness motored to London; they are to visit the Continent.

The marriage took place at Leamington Spa, on November 12th, of Mr. Eric R. Knight, of the Leicestershire & Warwickshire Electric Power Co.'s staff, and Miss Dorothy E. Stouthorn.

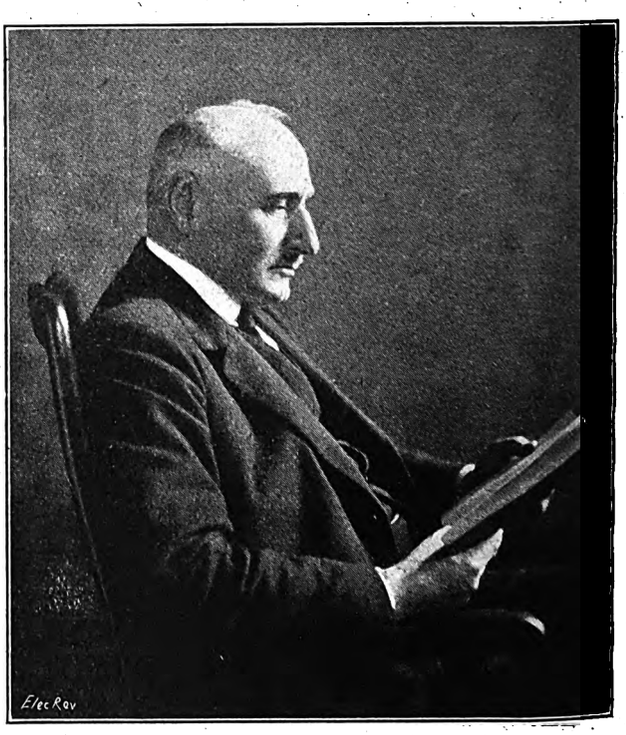
The marriage took place on November 9th, at Lymm, of Mr. Richard Macue, of the Warrington Corporation Electricity Department, and Miss Winifred Hewitt. The bridegroom received from his colleagues an inscribed chiming walnut clock.

The Barnes Urban Council on November 12th received the resignation of Mr. G. C. Law, assistant electrical engineer, who has been appointed deputy electrical engineer and manager by the Hammersmith Borough Council. The Council decided that its thanks for Mr. Law's services should be recorded on vellum and sealed.

Shoreditch Borough Council Establishment and Staff Committee recommends that Mr. A. F. Cox, outside engineer of the Hewittic Electric Co., Ltd., be appointed electrical maintenance engineer at a salary of £423 per annum.

Mr. R. A. Chattock, city electrical engineer of Birmingham, is to retire from the Corporation's service under the age limit in January next, after occupying the position since 1903. Mr. Chattock is a native of Solihull. He was educated at University College, London, and after serving his apprenticeship as a mechanical engineer at the Blackwall Ironworks, London, he became assistant engineer to the Metropolitan Electric Supply Co. In this position he obtained a very varied experience, being for the greater part of the time superintendent engineer at one of the company's stations. Later he became superintendent engineer of the Bankside generating station of the City of London Electric Lighting Co. He held this post for five years, and in 1900 he was appointed city electrical engineer of Bradford. Important extensions were carried out under his direction, and it was claimed for Mr. Chattock that he produced power at a cost lower than that at any similar station in the country. He was three years at Bradford, and on the acquisition by the Birmingham Corporation of the electricity supply undertaking, then under company management, Mr. Chattock was appointed to the chief executive office.

The growth of the Birmingham Electric Supply Department has been phenomenal. From time to time important extensions have been made under the direction of Mr. Chattock, who has long been regarded as one of the national leaders in his profession. He was responsible for the designing, erection, and equipping of the generating stations at Summer Lane and Nechells, for the enlargement of the latter station (one of the largest in the country), and more recently for the creation of the large "super" station at Hams Hall, Birmingham. During the war period Mr. Chattock devoted the whole of



Lafayette [*Manchester.*

Mr. R. A. Chattock,

Who is retiring from the position of City Electrical Engineer, Birmingham.

his energies to increasing the output of electric power in Birmingham to meet the demands of the munition factories. He was conspicuously successful, and to meet the enormous demand additional generating stations of a temporary character had to be established. Mr. Chattock is highly esteemed by the electrical profession of this country. For many years he has been closely identified with various professional

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organisations, and in 1925 he was elected President of the Institution of Electrical Engineers. He had previously filled the offices of President of the Incorporated Municipal Electrical Association, and of the Birmingham Association of Mechanical Engineers.

Mr. J. G. OGG, who has been radio engineer at the Metro-Vick Newcastle office, is leaving to take up an appointment under the Air Ministry (Technical Development Department).

It was announced last week that Mr. BERNARD D. F. DOCKER and Sir E. WYLDBORE-SMITH had retired from the board of Associated Electrical Industries, Ltd.

Mr. W R. CURTIS has relinquished his position in the Wiring Supplies Department of the British Thomson-Houston Co., Ltd., to take up an appointment as sales director to Messrs. Chas. Preston & Co., Ltd., of Berners Street, W.

A Bury paper states that Mr. H. B. DORRELL, who for many years has been mains superintendent to the Bury Corporation Electricity Department, has resigned in order to assist his brother in the management of a large building concern in London. He was recently presented with a barometer and lunch basket by his fellow employés.

Mr. EDWIN SEDDON, M.I.E.E., M.I.Mech.E., City Electrical Engineer, Edinburgh, has been elected president of the Royal Scottish Society of Arts.

Messrs. Richard Garrett & Sons, Ltd., of Leiston, have appointed Mr. CYRIL M. PLANE as sales engineer in connection with their electric trolley-'bus business. Mr. Plane has had a very close and lengthy experience of the design, manufacture, and installation of trolley-'bus vehicles.

Mr. E. MORGAN has now taken up his position as general manager of the City of Sheffield Electric Supply Department. His new permanent address is "Glensone," 23, Thornsett Road, Sharrow, Sheffield (telephone No. 50575.)

The Louth Town Council has appointed Mr. EDGAR MARSDEN, of New Mill, near Huddersfield, as electrical engineer at a salary of £300 per annum. The appointment is in connection with a new scheme by which the Town Council will be supplied with electricity in bulk by the Grimsby Corporation.

Mr. T. R. MARTIN having resigned his position as joint managing director of Messrs. J. H. Tucker & Co., asks that correspondence of a personal nature shall be addressed to him at his private address, "Highland Lodge," Wellington Road, Edgbaston, Birmingham.

The Bedford Electricity Committee has appointed Mr. H. W. MILLATT, showroom manager at Chester, as sales manager, at £400 per annum.

Sergt. J. B. HAMILTON, V.C., has been appointed a traveller on the staff of Messrs. J. J. Inglis & Co., Glasgow, in connection with the sale of "Tungsram" valves for which the firm is sole Scottish representative.

The Leeds Electricity Committee recommends the appointment of Mr. J. F. SARVENT as resident engineer at the Kirkstall power station. Mr. Sarvent is at present power station superintendent to the Hammersmith Borough Council.

In the note upon the registration of Armaflex (Parent), Ltd., in our last issue (p.915), Sir WILLIAM HORWOOD was described as a director of Philips Lamps (England), Ltd. The correct style of the company is, of course, Philips Lamps, Ltd.

Obituary.—MR. R. W. POPE.—We regret to learn from the *Electrical World* of the death, on November 1st, of Mr. Ralph Wainwright Pope, honorary secretary of the American Institute of Electrical Engineers. Mr. Pope, who commenced his career in the railway and telegraph services of the United States, became a journalist, and in 1885, the year following its organisation, he was appointed secretary of the Institute. In 1911 he resigned that position, and was thereupon elected honorary secretary for life.

MR. T. WILSON.—The death took place suddenly on November 19th of Mr. Thomas Wilson, Southwood, Stirling. Mr. Wilson, who was in his 60th year, had been in India for 30 years, being a director of the firm of Jessop & Co., civil, mechanical, and electrical engineers. He returned to this country in 1918.

Dr. W. C. ESCHER.—*The Financial Times* records the death of Dr. W. C. Escher, chairman of the Crédit Suisse in Zurich, and a distinguished figure in banking and industrial circles in Switzerland. "Besides acting as chairman of the Board of the Banque pour Enterprises Electriques, a powerful holding company for the shares of international electrical undertakings, which is closely allied to the Crédit Suisse, he was a director of the Cia. Hispano-America de Electricidad (better known as 'Chade'). Among Swiss industrial companies he was a director of . . . Entreprises Sulzer, the engineering concern."

Mr. W. B. SAYERS.—We regret to learn that Mr. William Brooks Sayers died on Sunday, November 17th, after a few days' illness, at the age of 68 years. He was born at Isleworth, Middlesex. Mr. Sayers was the inventor of the "Sayers" system, which utilised the armature winding for the compounding of dynamos and the suppression of sparking; it was extensively adopted in machines for some heavy duties. Other inventions relating to dynamos stand to his credit; lately he had been occupied with designs for some new uses of dynamos. He joined Colonel Crompton's staff at Chelmsford in 1882, where he had for colleagues the late Dr. Gisbert Kapp and Mr. James Swinburne. He assisted in the Birmingham Town Hall installation, carried out jointly by Messrs. Crompton and Winfield; this was then the largest incandescent lighting installation in the Midlands. Messrs. Chamberlain and Hookham were just at that time launching an electrical department, and they engaged Mr. Sayers's services for dynamo design. Some years later he became electrical designer to Messrs. Mavor & Coulson, who made the first dynamo with "Sayers" windings. About 1896 he set up as consulting engineer in Glasgow, where he was joined by his brother James, who continued the business after the late Mr. Sayers had retired from it. Mr. Sayers was twice married.

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Podmore's, Ltd.—Private company. Registered November 16th. Capital, £5,000 in 4,000 7½ per cent. participating preference shares of £1 each and 2,000 ordinary shares of 10s. each. Objects: To acquire the business of manufacturers of gas and electric heating and lighting and cooking apparatus, metal spinners, sheet metal workers and general merchants and dealers now carried on at 34, Charles Street, Hatton Garden, E.C.1, as "A. E. Podmore & Co." The subscribers (each with one ordinary share) are: Mrs. C. Olivier; S. T. Balls, electrical engineer; G. P. Olivier, engineer, all of 34, Cowcross Street; H. W. Hensman, 4, Brick Court, Temple, E.C.4, barrister; H. A. Chapman, 26, Vineyard Hill Road, Wimbledon Park, S.W.19, export merchant. Solicitors: M. L. Moss & Son, Savoy House, 115-116, Strand, W.C.2.

Huuter & Piquart, Ltd.—Private company. Registered November 16th. Capital, £300 in £1 shares. Objects: To carry on the business of manufacturers of, agents for and dealers in apparatus and accessories for use in connection with radio, in particular cables, wires, batteries, detectors, switches, condensers, head telephones, valves, receivers, amplifiers, and aerial and other insulators; manufacturers of and dealers in optical, photographic, musical, scientific, and other instruments, &c. The directors are: B. J. Hunter, 407, Edgware Road, W.; J. Piquart, 116, St. Paul's Road, Highbury, N. Qualification: £50 shares. Registered office: 21, Glasshouse Yard, Aldersgate Street, E.C.1.

Sam Sharples, Ltd.—Private company. Registered November 19th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of electrical and mechanical engineers and contractors for the carrying out of electrical and mechanical work, including electric lighting and power, &c. The subscribers (each with one share) are:—S. Sharples, 3, Hanging Ditch, Manchester, electrical engineer; S. Hindle, 78, King Street, Manchester, accountant. S. Sharples is permanent governing director. Solicitor: M. Rigby, 15, Cooper Street, Manchester.

Elite Iron and Wire Works Co., Ltd.—Private company. Registered November 19th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of manufacturers and workers of, and dealers in wire, cable, and ropes of all descriptions, mechanical, electrical, telegraph, telephone and wireless engineers, manufacturers of, and agents for lead pipes, agricultural and horticultural implements, &c. The first directors are:—Mrs. Ethel McElhatton, 1, Hilltop Avenue, Hill Lane, Blackley, Manchester (chairman); H. Bradshaw, 25, Mansfield Road, Blackley; H. C. Simpson, "Symbroc," Park Road, Gatley (assistant managing director of James Simpson & Co., Ltd.). The above directors are permanent. Secretary: H. C. Simpson. Registered office: 34, Upper Cyprus Street, Holt Town, Manchester.

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Official Returns of Electrical Companies.

Electrodrives, Ltd.—D. E. Evans, 29-30, King Street, Cheapside, E.C.2, was appointed receiver and manager on November 11th, under powers contained in debenture dated October 5th, 1929.

British Automatic Refrigerators, Ltd.—Debenture dated November 11th, 1929, to secure £20,000, charged on land at Rotherham, and the company's undertaking and property, present and future, including uncalled capital. Holders: Branch Nominees, Ltd.

Wolf & Morgan, Ltd. (formerly Wagner Electric Supplies, Ltd.).—Issue on November 6th, 1929, of £1,000 debentures, part of a series already registered.

Craven Hydro-Electric Supply Co., Ltd.—Debenture dated October 24th, 1929, to secure £5,000, charged on the company's property, present and future, including uncalled capital. Holders: Linton Mills Estates Co., Ltd.

Kalgoorlie Electric Tramways, Ltd.—Capital, £250,000 in £1 shares. Return dated July 29th, 1929. All shares taken up. £250,000 paid. Mortgages and charges, £119,800, and interest accrued on 6 per cent. "B" stock from April 1st, 1912.

Indo-European Telegraph Co., Ltd.—Capital, £450,000 in £25 shares. Return dated May 9th, 1929. 17,000 shares taken up. £425,000 paid. Mortgages and charges, nil.

W. T. Henley's Telegraph Works Co., Ltd.—Capital, £1,000,000 in 800,000 ordinary shares of £1 each and 40,000 preference shares of £5 each. Return dated July 26th, 1929. 650,000 ordinary and 40,000 preference shares taken up. £612,480 paid on 413,080 ordinary and 39,880 preference shares. £237,520 considered as paid on 236,920 ordinary and 120 preference shares. Mortgages and charges, £150,000.

Concordia Electric Wire Co., Ltd.—Capital, £100,000 in £1 shares. Return dated July 12th, 1929. 57,319 shares taken up. £57,319 paid. Mortgages and charges, £33,600.

Newquay Electric Light and Power Co., Ltd.—Capital, £50,000 in £1 shares. Return dated May 9th, 1929. 45,000 shares taken up. £34,820 paid. £10,180 considered as paid. Mortgages and charges, nil.

A. W. Penrose & Co., Ltd.—Capital, £45,000 in 10,000 first preference, 5,000 second preference, and 30,000 ordinary shares of £1 each. Return dated June 5th, 1929. 10,000 first preference, 500 second preference, and 30,000 ordinary shares taken up. £10,507 paid. £29,993 considered as paid. Mortgages and charges, £1,100.

Rhondda Tramways & Electric Supply Co., Ltd.—Capital, £100 in £1 shares. Return dated May 30th, 1929. Seven shares taken up. £7 paid. Mortgages and charges, £54,000.

Ellis & Ward, Ltd.—Capital, £10,000 in 2,000 preference and 8,000 ordinary shares of £1 each. Return dated August 5th, 1929. 1,000 preference and 6,003 ordinary shares taken up. £1,003 paid on 1,000 preference and 3 ordinary shares. £6,000 considered as paid on 6,000 ordinary shares. Mortgages and charges, nil.

Electricity Distribution of North Wales and District, Ltd.—Capital, £205,500 in 200,000 preference shares of £1 each and 110,000 ordinary shares of 1s. each. Return dated May 27th, 1929. All shares taken up. £164,500 paid (being £1 per share on 150,000 preference, 5s. per share on 50,000 preference, and 1s. per share on 40,000 ordinary shares). £3,500 considered as paid on 70,000 ordinary shares. Mortgages and charges, £150,000.

Shoreham and District Electric Lighting and Power Co., Ltd.—Capital, £27,500 in £1 shares. Return dated April 25th, 1929. 17,329 shares taken up. £10,829 paid. £6,500 considered as paid. Mortgages and charges at date of return: £16,200. Issued October 1st, 1929: £1,300 6 per cent. ten-year notes.

Rheostatic Co., Ltd.—Capital, £25,000 in £1 shares. Return dated July 5th, 1929. 12,000 shares taken up. £9,721 paid. £2,279 considered as paid. Mortgages and charges, £2,618 6s. 10d. A return of allotments, made up to July 26th, 1929, shows a further 3,501 shares allotted, payable in cash and fully called up.

Yorkshire Electric Transformer Co., Ltd.—Capital, £5,000 in £1 shares. Return dated May 11th (filed July 24th), 1929. 4,430 shares taken up. £4,430 paid. Mortgages and charges, nil.

Luth & Rosen Electric Co., Ltd.—Capital, £1,000 in £10 shares. Return dated April 27th, 1929. All shares taken up. £1,000 paid. Mortgages and charges, nil.

Mansbridge Condenser Co., Ltd.—Capital, £25,000 in £1 shares. Return dated September 10th, 1929. All shares taken up. £10,000 paid. £15,000 considered as paid. Mortgages and charges, nil.

T. W. Broadbent, Ltd.—Capital, £5,000 in 440 5 per cent. preference and 560 ordinary shares of £5 each. Return dated August 6th, 1929. All shares taken up. £35 paid on 7 ordinary shares. £4,965 considered as paid on the remainder. Mortgages and charges, nil.

Hydro-Electric Power & Public Services Trust, Ltd.—Capital, £500,000. Return dated June 18th, 1929. £100,000 6 per cent. cumulative preference stock and £287,705 ordinary stock taken up. £387,705 paid. Mortgages and charges, nil.

Clowne Electric Supply Co., Ltd.—Capital, £3,000 in £1 shares. Return dated May 30th, 1929. All shares taken up. £3,000 paid. Mortgages and charges, nil.

Kalgoorlie Electric Power & Lighting Corporation, Ltd. Capital, £50,005 in 5 preference shares of £1 each and 100,000 ordinary shares of 10s. each. Return dated June 6th, 1929. All shares issued and fully paid up. Mortgages and charges, £102,880.

Belshaw & Co., Ltd.—Capital, £3,000 in 2,500 preference and 500 ordinary shares of £1 each. Return dated October 9th, 1929. 2,000 preference and 500 ordinary shares taken up. £2,500 considered as paid. Mortgages and charges, nil.

Adamant Supplies Co., Ltd.—Capital, £5,000 in £1 shares. Return dated July 12th, 1929. 2,603 shares taken up. £502 paid. £2,101 considered as paid. Mortgages and charges, nil.

Wood & Co. (Ipswich), Ltd.—Capital, £3,500 in 1,000 preference and 2,350 ordinary shares of £1 each and 3,000 founders' shares of 1s. each. Return dated August 31st, 1929. All shares taken up. £3,350 paid on 1,000 preference and 2,350 ordinary shares. £150 considered as paid on 3,000 founders' shares. Mortgages and charges, nil.

Cuba Submarine Telegraph Co., Ltd.—Capital, £220,000 in 6,000 preference and 16,000 ordinary shares of £10 each. Return dated August 30th, 1929. All shares taken up. £220,000 paid. Mortgages and charges, nil.

Gorseinon Electric Light Co., Ltd.—Capital, £60,000 in £1 shares. Return dated March 29th, 1929. 57,000 shares issued and fully paid up. Mortgages and charges, nil.

Royce, Ltd.—Capital, £170,000 in 70,000 preference and 100,000 ordinary shares of £1 each. Return dated September 4th, 1929. 34,955 preference and 72,487 ordinary shares taken up. £27,461 paid (being £1 per share on 4,955 preference and six ordinary and 15s. per share on 30,000 preference shares). £79,981 considered as paid (being £1 per share on 72,481 ordinary and 5s. per share on 30,000 preference). Mortgages and charges: £24,871 17s.

Coatbridge & Airdrie Electric Supply Co., Ltd.—Capital, £200,000 in £1 shares. Return dated May 17th, 1929. 158,200 shares taken up. £157,200 paid. £1,000 considered as paid. Mortgages and charges, nil.

Electro Dynamic Construction Co., Ltd.—Debenture charged on deeds and documents relating to Dynamo Works, Devonshire Grove, S.E., and the company's undertaking and property, present and future, including uncalled capital, dated November 8th, 1929, to secure all moneys due or to become due from the company to Lloyd's Bank, Ltd.

Peter Raven & Co., Ltd.—Particulars filed of £1,000 debentures, authorised October 10th, 1929, charged on the company's undertaking and property, including uncalled capital, the amount of the present issue being £400.

City Notes.

Indo-European Telegraph Co., Ltd.

The directors have notified the shareholders of an offer to purchase their holdings by Imperial & International Communications, Ltd. The basis of the offer, which has been provisionally accepted, is £55 cash for each £25 share, and it is stipulated that the offer is conditional upon acceptance by holders of 90 per cent. of the issued capital. The directors consider the offer a satisfactory one, and advise its acceptance. Upon the completion of the purchase, Mr. H. L. M. Tritton, Sir Rayner C. Barker, Mr. F. J. Brown, and Mr. C. H. Tritton will retire from the board, and will receive as compensation £27,000 to be divided between them. In the case of the managing director (Mr. Axel W. Berg), £30,000 is to be put on trust for payment to him upon loss of office, unless he is offered and accepts other employment with the company or the Communications Company. Compensation will also be awarded to any members of the British and foreign staffs who are displaced as a result of the purchase.

Ferranti, Ltd.

The annual meeting was held on November 21st, Dr. S. Z. de Ferranti (chairman) presiding. In presenting the report and accounts, the chairman said that the balance-sheet showed that £44,867 had been spent on additional buildings, plant, machinery, &c. The bank overdraft was £96,805, and this position arose partly from the fact that the balance of the first mortgage debenture stock was paid off in 1928 (approximately £48,000), and in other part to the expansion of trading which had taken place. It was anticipated that this expansion would continue, and this would necessitate raising further capital. The board was considering the method by which this further capital should be raised, and it might be that their suggestions would have to be submitted to the shareholders for approval. The report and accounts were adopted.

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Cape Electric Tramways, Ltd.

The report for the year ended June 30th last records a profit of £32,755 (against £38,348 for 1927-28). After providing for debenture interest, &c., there remains a balance of £13,314, to which is added £28,626 brought forward, making £41,940. It is proposed to transfer £5,000 of this to reserve, and carry forward the balance (£36,940). The directors regret that they are again unable to recommend a dividend, and refer to the continuance of severe motor-omnibus competition. The wages paid by competitors are far below those which the company is forced to pay. Steps are being taken by the Government and municipalities to deal with the present uncontrolled competition, and there is some hope of improvement in the near future. In order to reduce expenses it is proposed to transfer the entire control and management of the company to South Africa. At the annual meeting on December 18th a resolution to effect this and altering the articles of Association, will be put forward.

Telephone Manufacturing Co., Ltd.

At an extraordinary meeting on Monday last the proposals for separating the two parts of the company's business—installation and manufacturing—(outlined in our issue of November 8th, p. 824) were approved. Mr. F. T. Jackson, chairman and managing director, said that the adoption of the scheme would enable the shareholders to participate in the progressive prosperity of the subsidiary companies engaged in installing private telephone systems on a rental basis. It was hoped that the installation company's business would so develop that in a short space of time it would occupy a large proportion of the manufacturing company's factory accommodation. In conclusion, Mr. Jackson said that immediately the necessary formalities had been completed, the installation company—Telephone Rentals, Ltd.—would declare an interim dividend of 2½ per cent., and a final dividend in the early part of next year.

Electro Dynamic Construction Co., Ltd.

The annual meeting was held on November 14th. The chairman (Mr. N. Pensabene-Perez), in presenting the accounts for the year 1928-29, stated that the balance sheet showed a very satisfactory and progressive state of affairs, and proposed the following dividends:—10 per cent. on the first preference shares; 7½ per cent. on the second preference shares; and 10 per cent. on the ordinary shares. The chairman said that the development that had taken place in connection with the firm's polyphase variable-speed motor had resulted in a very successful and commercially sound machine, for which there was a rapidly-increasing demand. The volume of business received from the Admiralty and other Government Departments had materially increased; the prospects for the future were good.

Stock Exchange Notices.

Application has been made to the Committee to allow the following to be officially quoted:—

Atlas Light and Power Company.—250,000 ordinary shares of £1 each, fully paid, Nos. 2,750,001 to 3,000,000.

Shropshire, Worcestershire and Staffordshire Electric Power Co.—200,000 six per cent. cumulative preference shares of £1 each, fully paid, Nos. 1,950,001 to 2,150,000.

East India Tramways Co., Ltd.

The gross receipts for the year ended July 31st, 1929, were £50,330, and the balance on working amounted to £14,177. To this is added £491 brought forward, making £14,668. The reserve for renewals receives £500, £1,500 is set aside for income tax, the dividend on the preference and ordinary shares is 5 per cent. (half already paid), and the deferred shares are to receive 10 per cent., leaving £622 to be carried forward.

Lighting Trades, Ltd.

The accounts for the year ended March 31st, 1929, show a credit balance of £1,311, this is added to the sum of £3,125 brought in, and the whole amount (£4,436) is carried forward. The volume of sales is said to have been satisfactory, although prices have been depressed by competition. During the year £16,500 of first-charge debenture stock was redeemed.

American Gas and Electric Co.

The stockholders have received a circular assuring them that the recent events on Wall Street have had no adverse effect upon the real value of the company's holdings. Earnings are said to be increasing, and contracts for large amounts of new business are being received. The company's assets are valued at over $400,000,000.

Ebonite Container Co., Ltd.

The directors propose to increase the capital to £400,000 by the creation and issue of 200,000 4s. shares. The proceeds will be utilised to acquire a controlling interest in an old-established business which is not named. The new shares will be offered at par to existing shareholders.

Buenos Ayres Town and Docks Tramways, Ltd.

The accounts for the year ended June 30th last show gross receipts of £179,891, against £169,219 in 1927-28, and net receipts amounting to £36,029 (£36,848), working expenses having been higher. Adding £4,719 brought forward and interest, and deducting debenture interest, &c., the balance available is £42,209. Of this £20,000 is put to renewals reserve, £1,000 is written off the cost of works, and a dividend of 3½ per cent. is being paid, leaving £3,881 to go forward.

Dutch Company.

At the resumed extraordinary general meeting of shareholders of Philips Glow Lamp Works, on November 21st, the increase of capital by £1,250,000 to £2,100,000 was agreed to. Asked whether it was true that a fusion between Philips Glow Lamps and the Splendor Factory had been arranged, the chairman replied that in the interests of the company no exact information could be given. All he could say was that, though a fusion had not yet been concluded, negotiations between the two companies were proceeding.—*Financial Times.*

Stocks and Shares.

TUESDAY EVENING.

THE severe shake-out in most Stock Market securities during the current month, has served to leave the markets in a sensitive condition, and one in which the effects of a number of cross-currents are abruptly marked from time to time. There is, for example, the hope that the Bank of England will further reduce its rate to 5 per cent., and in the near future. This acts as an encouragement to markets for investment stocks and shares, and removes altogether the apprehension entertained not so very long ago, that the money market would become more stringent instead of easier. The City was talking of a 7, or even a 7½ per cent., Bank Rate, so that the present 5½ per cent. to which the minimum was reduced last Thursday, is a pleasant surprise to those who looked for money to be tight up to the end of the year. The reason is, of course, that the American débâcle released enormous sums of money through the curtailment of New York brokers' loans. British capital that was being employed in America is now flowing back to this country, the result being that investment stocks and shares, as a whole, stand to benefit by the ill wind which blows good to the investor at the expense of the speculator.

The American Buyers.

Most of the British stocks and shares in which New York took a substantial interest a little while ago, and which came down heavily in price at the time of the various American panics, are now on the upgrade. For instance, Underground Electric income bonds slumped, at one time, to 101, but are now 107. Northampton Electrics, which fell to 38s., have rallied to 44s. 6d. Associated Electrics touched 27s. 6d., and G.E.C. ordinary 42s. 6d. before recovering to their present prices of 30s. and 46s. 3d., respectively. Cables & Wireless ordinary stock dropped to 35; the present price is 10 points higher. The effect of the New York panic may be said, therefore, to to have exhausted itself, so far, at all events, as the purely British companies' stocks and shares are concerned. Some people are saying, now, that it is a pity the American appetite for shares in British companies, *e.g.*, the General Electric Co., Ltd., was checked by the action of the companies in refusing to allow control to pass out of British hands. The prices offered, and paid, by American interests, were mostly a great deal higher than those now current, and America has been willing enough to sell back again a good deal of stocks and shares that she bought previously at the high prices.

Dollar Stocks.

American Telephone and Telegraph stock, which is one of those which has been moving most mercurially, at 230 shows a gain of 3 points on the week, while International Telephone and Telegraph at 75 is 5 points up. Brazilian Tractions further advanced to 43½, and the preference at 150 show a recovery of 20. Hydro-Electrics have risen from 34½ to 38½, after touching 40. Of the utility shares, Montreal Light, Heat & Power at 120 have recovered the 4½ points that they shed last week, and Pennsylvania Water & Power shares, at 82½, are 2 points up. Power Corporation of Canada at 82½ being 5 to the good. Mexican Light & Power are unchanged at 75. Shawinigan Water common shares at 81 are 5½ up. The general tendency, it will be seen, has been in an upward direction. Some of the movements are almost entirely due to New York dictation, business in the shares on this side being confined to a mere trickle excepting in Brazil Tractions, Nickels and one or two others.

Fortunes Refused.

Looking at the prices which obtained only a month ago, it is difficult—if jobbing backwards may be permitted— to see any justification for the levels that were reached by shares in a number of the popular American utility companies. The public's memory for financial operations is notoriously short, otherwise no sane person would have dreamed of paying the prices that prevailed for shares which had been, but a few years before, split from their original constituents into four, six, eight and sometimes, ten times the value of the shares when first issued. The odd part of it is that a good many people refused, sometimes brusquely, to accept even part of the really big fortunes that they could have secured by selling at the prices of some few weeks ago, which showed enormous appreciation over the original amount of money that

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they put into the shares. In spite of the slump, there are handsome profits to be secured to-day by those who bought certain of the American utility issues at the time when the shares were introduced to this side, though the money realisable by the sale of such shares is now very much less than that which could have been obtained when the recent boom was at its height.

Shares on Offer.

Charing Cross Electric 4½ per cent. preference can be bought at 17s. 6d., to pay £5 2s. 9d. per cent., and the company's 4½ per cent. City Undertaking preference at the same price. Dividends in the first case are due in the middle of February and August; in the latter at the end of January and July. The City of London Electric 6 per cent. first preference are on offer at 22s. 6d., March and September dividends, to pay £5 6s. 6d. per cent., the dividends on these shares being covered many times over by earnings as shown by the last report. Edison Swan 7½ per cent., first preference are obtainable at 25s., at which the return is 6 per cent. on the money, with dividends in February and August, and Edmundson's 7 per cent. preference cost 24s. 6d., yielding £5 14s. 3d., with dividends due in the middle of January and July. The same price is asked for G.E.C. 5½ per cent. "A" preference, the return in this case being £5 6s. per cent. on the money, and the next half-yearly dividend falling due at the end of January. Newcastle-on-Tyne Electric 7 per cent. first preference, of which there are 1,000 on offer at 25s. 6d., yield 5½ per cent., with dividends in March and September; and 5,000 of the same company's 5 per cent. non-cumulative preference shares can be obtained at 19s. 9d., to pay £5 1s. 3d. per cent. These last shares carry participating rights, ranking for a further 3 per cent. after the ordinary shares get 8 per cent dividend. In the last two years the ordinary dividend has been 6 per cent. per annum. A share whose dividend is well covered by earnings is the South Metropolitan Electric Light & Power 7 per cent. preference, of which about 1,500 can be obtained at 25s. 6d., showing a yield of 5½ per cent., and with dividends payable on February 28th and August 31st.

Electricity Supply.

After the falls which overtook a good many of the shares in the electricity supply section, a mild recovery has ensued in the case of a few, Bournemouth & Poole, for instance, being ½ up to 58s. 9d., Midland Counties to 27s. 6d., Scottish Power to 29s., and Yorkshire Electrics to 32s. 6d. Clyde Valley rose 1/16 to 36s. 3d. Midland Counties new shares have improved to 6d. premium; Scottish Power new shares at 28s. 6d. are 9d. better. The new Metropolitans are unchanged at 4s. 9d. premium. Isle of Thanet at 31s. 6d., and Northamptons at 44s. 6d., are up 6d. and 2s. 6d., respectively. Egham & Staines at 35s. show a better front. British Power & Light at 14s. 9d. are 9d. harder, there being a little appreciation of our observation last week that the shares looked, at 14s., reasonably cheap as a speculative investment. Atlas strengthened to 28s., but the preference at 23s. 6d. are inclined to be easier.

Telegraphs and Telephones.

The two Cables & Wireless ordinary stocks are better, the "B" gaining 3 points at 45½. When dealings started early last July in Cables & Wireless, some of the stockholders sold their "B" at prices ranging from 90 to 100, and put the money into the 5½ per cent. preference at about the same level. The slump in the former has offered, therefore, exceptional temptation to those who like to see two blades of grass where only one blade grew before, and re-purchases stayed the headlong fall which lowered the stock, at one time, to 35. The offer of £55 per share for Indo-European Telegraphs is likely to be accepted, but the price has gone back to 52½. There are always people willing to get out, in a case like this, in advance of the final payment, and at a lower price than that offered. Marconi Marines are ½ better at 2 3/16. A rise of 3d. in Telephone Manufacturing to 4s. 3d. middle, followed upon the shareholders' acceptance of the proposals for reorganisation of the company.

Manufacturing Companies.

Henley's are the outstanding feature of strength in the group of manufacturing companies' shares. The price fell 5s. last week, but this week, at 57s. 8d. xd, it shows a gain of 6s. 3d., allowing for deduction of the dividend last Thursday. Johnson & Phillips are also ex dividend, and at 36s. 3d. they are practically a florin better. Enfield Cable ordinary, at 4½, have recovered the 2s. 6d. from which they parted last week. Callender's, curiously enough, which were amongst the few strong spots in our last report, have dropped the half-a-crown which they gained at that time. British Aluminium rose 1s. 6d. to 46s. Various rumours are current as to probable amalgamations amongst a number of electrical manufacturing companies, and this serves to keep alive speculative interest. English Electrics have fallen to 6s. 3d. British Electric Transformer preference have been changing hands at 10s. 6d. Babcock & Wilcox, with a rise of 3s. 9d., recovered to 3½. Iron and steel shares are rather better as a whole, there being some tendency, according to jobbers in the market, for investment to seek the shares in this group for speculative purchase. The rubber share market is unconcerned at present, from the point of view of prices, with the various schemes which are being put forward with the intention of restricting output.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Approx. Dividend. 1927.	1928.	Price Nov. 26 1929.	Rise or fall	Yield p.c.
Bournemouth and Poole	£ 1	15	15	58/9	+½	5 2 0
Brompton Ordinary	1	8½	8½	26/-	—	5 7 8
Charing Cross Ordinary	1	8½	8½	26/6	—	5 5 8
do. do. 4½% Pref. ...	1	4½	4½	17/-	—	5 6 0
Chelsea	1	8¾	8¾	25/-	—	5 12 0
City of London	1	10	10	32/-	—	6 7 6
do. do. 6% Pref.... ...	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	1+⅛	+1/16	... ...
County of London	1	7	10	48/9	+6d.	4 2 0
do. do. 6% Pref.... ...	1	6	6	22/6	—	5 6 8
Edmundson's 7% Pref.	1	7	7	24/-	—	5 16 8
Elec. Supply Corporation	1	11	11	48/3	—	4 11 8
Kensington Ordinary	1	8	8	26/-	—	5 7 8
Lancs. Light and Power	1	7½	7½	27/-	—1/-	5 11 2
London Electric	1	8½	9	27/-	—	5 1 10
Metropolitan	1	9	9	36/3	—	4 19 4
do. 4½% Pref.	1	4½	4½	17/-	—	5 6 0
Midland Counties	1	6½	6½	27/6	+6d.	4 14 6
Mid. Elec. Power	1	15	8	33/9	—	4 14 10
Newcastle-on-Tyne Ordinary ...	1	6	6	23/9	—	5 1 1
do. 7% Pref.	1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	10	6	6	11	—	5 9 1
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	1	8	8	26/-	—	5 7 8
Scottish Power	1	8	8	29/-	+6d.	5 13 8
South London	1	8½	8½	25/6	—1/-	5 9 10
Urban Ordinary	1	7	7	35/-	—2/-	4 0 0
Westminster Ordinary	1	8½	8½	25/-	—6d.	5 13 0
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	23/6	—	6 7 8
Yorkshire Elec.	1	8	8	32/6	+6d.	4 18 6

Home Rails.

Central London Ord. Assented ...	Stock	4	4	71	—	5 13 8
Metropolitan	,,	8	8½	61½	+1	5 13 10
do. District	,,	4	5	72½	+½	6 18 0
Underground Electric	£1	5	7	22/6	+6d.	6 4 5
do. do. Income ...	Bonds	6	6	107	+2	5 12 2

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	99½	—	6 0 7
do. Def.	,,	1½	1½	24½	—	6 4 5
Automatic Telephone	1	10	12½	87/6	—	6 13 4
Cables & Wireless 5½ Pref.	Stock	—	—	96½	—	5 14 0
do. A 7½ Ord.	,,	—	—	81½	+2	... ...
do. B Ord.	,,	—	—	45½	+3	... ...
Globe Tel. and T. Ord.	10	10	10	23	—	*4 7 0
do. do. Pref.	10	6	6	10½	—	5 9 1
Great Northern Tel.	10	20	17½	29	—	6 0 9
Indo-European	25	10	10	52½	—2½	*3 16 3
Marconi-Marine	1	12½	15	2 3/16	+⅛	... ...
Oriental Telephone Ord	1	12	12	2 1/16	—	... ...

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	£ 5	5½	5½	8 1/16	—	8 19 6
do. do. 2nd Pref. ...	5	6	6	6 1/16	—	9 18 0
do. do. 5% Deb. ...	Stock	5	5	72½	—	6 18 0
British Electric Traction Def. Ord.	,,	5	5	1400	+150	... ...
do. do. Pref. Ord.	,,	8	8	120xd	—	6 13 4
Brazil Traction	100	7	8	43½	+1½	4 11 6
Brit. Columbia Elec. Rly. Pcc. ...	Stock	5	5	87½	+1	5 14 8
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	9/-	—	... ...
London United Tram Deb. ...	Stock	4	4	51½	—	7 15 4
Mexico Trams, 5% Bonds	—	5	5	65	—	7 12
Mexican Light Common	100	Nil	Nil	75	—	... ...
do. 7% Pref.	100	7	7	77½	—	9 0 8
do. 1st Bonds	—	5	5	77½	—	6 9 0
Yorkshire (West Riding)		Nil	Nil	5/-	—	... ...

Manufacturing Companies.

Assoc. Elec. Ord.	£ 1	6	—	1½	+6d.	4 0 0
Babcock & Wilcox	1	18	15	62/6	+3¾	*4 16 2
British Aluminium Ord.	1	10	10	46/-	+1/6	*4 7 0
British Elec. Transformer Pref. ...	1	7	7	18/-	—	... ...
British Insulated Ord.	1	15	15	8½	—⅛	4 0 0
Brush Ord.	Stock	10	10	126½	—	7 18 1
Callenders	1	15	15	38	—	4 9 9
do. 6½% Pref.	1	6½	6½	1½	—	5 4 0
Crompton Parkinson Ord.	5/-	—	30	20/-	—6d.	7 10 0
do. 8% Pref.	1	8	8	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	7 1 8
do. 5% Deb.	Stock	5	5	84½	—	5 18 4
Electric Construction	1	7½	5½	15/-	—	7 6 8
Enfield Cable Ord.	1	20	20	4½	+⅛	4 9 0
English Electric	1	Nil	Nil	6/8	—	... ...
do. do. Pref.	1	8	Nil	8/9	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
do. Ord.	1	10	10	2 7/16	+1/16	4 6 7
Henley...	1	25	30	57/8xd	+6/8	5 3 0
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	Nil	Nil	11/8	—	... ...
Johnson & Phillips	1	10	—	36/3xd	+ 2/-	5 10 3
Siemens Ord.	1	7½	7½	26/3x d	—	5 14 8
Telegraph Construction	12	10	12	23	—	5 4 2

*Dividends paid free of Income Tax.

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The B.E.A.M.A.

Speeches at the Annual Dinner: Review of a New Monograph.

ON November 20th the British Electrical and Allied Manufacturers' Association held its annual dinner at the Connaught Rooms. LORD DERBY (president) presided over a distinguished gathering which included several members of the Government and leading technical and commercial men.

After an excellent dinner, during which Royal Artillery bandsmen discoursed music, and the loyal toast, the Right Hon. J. H. THOMAS, M.P., Lord Privy Seal, rose to propose the toast "Electricity in Industry and Transport." Following a few quips at the expense of the chairman, Mr. Thomas said that the prosperity of the electrical industry was cheering to a Minister charged with seeking solutions of the unemployment problem. That industry was a challenge to the world and gave the lie to the belief that this country was down and out. The export trade was in a healthy state, and during the past seven months orders for heavy electrical plant to the value of £7,000,000 had been obtained abroad in the face of foreign competition.

The Home Market.

Then, again, although pessimists pointed to slackness in the home market, during the past seven months British undertakings had placed 12½ million pounds' worth of orders for heavy plant. In the view of the Electricity Commissioners a sum of £100,000,000 should be spent on transmission and distribution systems during the next five years, so that in that field alone the electrical industry had a solid block of orders to fall back upon. Since 1927 the Central Electricity Board had placed contracts to an amount exceeding £10,000,000. There was every reason to think that the slight set-back in the index of production of electrical apparatus for home use was only temporary, and there were signs that our curve of electrical activity was rising in relation to most other countries. Expenditure upon electrical equipment was thoroughly economic; it led to immediate and continued employment and improved the country's economic equipment. It was easy to find work by spending money, but that was no solution of the problem. Ultimately the solution lay in the improvement of our export trade. Our high standard of living militated against the quoting of low prices in foreign markets. That standard could only be maintained by everyone doing his utmost, by the highest technical efficiency and by co-operative action. The greatness of this country in the past had been due to courage, tenacity, and self-reliance, and that was one reason for the prosperity of the electrical industry. While there were many ways in which a Government could and should assist, an industry must first help itself.

A "Raw Recruit's" View.

Responding to the toast, SIR FELIX J. C. POLE, chairman of Associated Electrical Industries, Ltd., described himself as a "raw recruit" to the industry. He pointed out, however, that he was only one of a number who had left the G.W.R. to join the electrical industry; he particularly mentioned Sir Daniel Gooch and Mr. C. E. Spagnoletti. As a railway man he thought he knew something about competition; but after studying conditions in the electrical industry he had come to the conclusion that he was wrong. Although there was a popular impression that by combination the electrical manufacturers were managing to secure a satisfactory margin of profit, that was not the case. In addition to strong domestic competition, which indicated the need for closer co-operation, there was a tendency in some quarters to obtain quotations from foreign firms for use in beating down the prices of British tenderers. In the long run that procedure would not result in the best equipment or service. We lived in the most highly taxed country in the world, hours and wages were more onerous here than in many competing countries and the cost of social service was increasing. It was unjustifiable that foreigners could penetrate our home market while we found it so difficult to get into theirs. The industry was in need of similar protection to that which the Government was instituting in the case of the coal industry. They were prepared to make sacrifices to get export business to fill their factories, which, drawing a parallel with the railways, could be considered "excursion traffic." No railway could live by carrying all its passengers at excursion rates, but those rates enabled it to utilise productive capacity which would otherwise be wasted. If railway companies, municipalities, statutory supply undertakings, and other bodies forced down prices to the level of foreign quotations, which represented *their* excursion traffic, the industry could not survive. He asked the Government to revive and extend the Trade Facilities Act to afford the electrical industry facilities for financing large contracts at home and abroad. Sir Felix said that he was impressed by the skill and keenness of electrical engineers and their workpeople, and by the close co-operation which existed between the engineers and their customers. He had seen in America the potentialities of electricity, and he looked forward to rapid development in this country, aided by the activities of the Central Electricity Board.

"Our Guests."

LORD DERBY then proposed the health of the guests. He drew attention to the strong representation of the Government at the dinner and, while wishing them the best of health individually, said he hoped for their early end collectively. Seriously, however, he sympathised with any Government which had to face the problem of unemployment. That problem was a national, not a partisan, question, and he was one of a growing body of people who, while not sacrificing their principles, were prepared to support any movement towards finding useful work for our unemployed. He was unable to mention all of their distinguished guests by name, but he coupled with the toast the name of Mr. Herbert Morrison, the Minister of Transport, and wished him success in the great tasks with which he had to deal.

MR. MORRISON, replying, said that for many years he had been keenly interested in the electricity supply industry and referred to his tuition by Mr. Robinson, the Hackney electrical engineer. He congratulated British electrical manufacturers upon their success in overseas markets, and said that he believed that if the same progress had not been made at home it was due not so much to foreign competition as to the slower rate of development. Recently in company with the Lord Privy Seal he had met representatives of the electricity supply industry to urge a speeding-up, and they were gratified by the helpful spirit in which their suggestions had been received.

Electricity in the Home.

Hundreds of thousands of houses were equipped for lighting only. That was all very well in its way, but an undertaking that was content with that state of affairs was not doing its job. It should be campaigning day in and day out to persuade private consumers to do what he (the speaker) had done in his own house, namely, to use electricity for lighting, cooking, heating, water heating, and many other purposes. One of the greatest problems was the cost of installation, and here the industry could learn from its progressive competitor the gas industry. By hire-purchase or rental, and even by taking some risk in capital expenditure, electricity undertakings must persuade domestic consumers to use electricity for purposes other than lighting. If there were people in the electricity supply industry still following the policies of "Safety first" and "High prices and quick profits" the sooner they got out of the industry the better. In spite of all, however, progress in this country had been remarkable. Between 1922 and 1928 the sales of electricity had risen by 108 per cent. In the last seven months 500 applications for consent to the erection of overhead lines had come before the Commissioners, and sanction had been given in the majority of cases. Since April last, the Commissioners had issued loan sanctions to local authorities to the extent of £10,000,000 for electrical purposes. Together with the Commissioners and the Board he was giving special attention to rural electricity supply. The work of the Board was proceeding more rapidly than had been anticipated, and already six schemes had been transmitted to the Board by the Commissioners. These provided for the establishment of 1,870 miles of 132,000-V lines, and it was estimated that during the next ten years over 4½ million kW of plant would be required.

The B.E.A.M.A. and its Critics.

MR. V. WATLINGTON (chairman of the B.E.A.M.A. Council) proposed the health of Lord Derby. In doing so, he made mention of the criticisms to which the Association was constantly subject. He said that it had been blamed by an important section of its customers—the railways—for quoting identical prices for similar articles, although he had found that before the railway amalgamation four railway companies charged exactly the same fare for the journey between London and Sheffield although the mileage was not the same. Now that two groups served Sheffield they still quoted identical prices. They had also been blamed by some of their municipal friends for quoting lower prices for export than at home; yet some of those same municipalities encouraged that practice when they placed orders with foreign firms which were quoting lower average prices in this country than they obtained in their own protected markets. No one, however, had ever criticised the Association's good fortune in having Lord Derby as its president.

LORD DERBY, who was accorded "musical honours," briefly acknowledged the toast and the proceedings concluded.

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A Comprehensive Industrial Survey.

THE monograph published this week by B.E.A.M.A.* is one of first-hand importance to all electrical engineers. It may be said to give a statistical cross-section of the whole supply and manufacturing industry, whilst at the same time "placing" it relative to other industries of the country and other countries of the world. The figures given go far to abolish uncertainty and enable manufacturers and others to plan ahead, and bring their productive capacity into line with market requirements. Taken in conjunction with the monograph on trusts some time ago from the same authors, it should make the British electrical industry one of the best documented and most scientifically guided in the world.

The Two Manufacturing Groups.

The first section deals with the economic configuration of the industry. The manufacturing industry is in the first place divided up into two groups:—(1) The heavy plant and equipment group, producing capital goods; and (2) the mass-production group, which is engaged almost exclusively in turning out consumption goods. The supply industry is in vital relationship to both groups since it forms the chief market for the products of group (1), whilst by reducing energy prices it is the main stimulant of markets for the second group. Taking group (1), this is engaged in manufacturing plant for the supply industry, for industrial electrification and for electric traction. As the dominant characteristic of electricity supply is a low rate of capital turnover, the result has been to concentrate attention on the capital installation itself. Quality and efficiency are then the determining factors, whilst depreciation, apart from obsolescence, has to be reduced to a minimum. Manufacturers in group (1) must therefore rely for their market not on the wearing out of old plant but on new schemes and extensions, and also upon rendering the old sets obsolete by the ever-increasing efficiencies of the new. Another factor which has operated to the detriment of this group of manufacturers is the call for larger and larger units. Not only does one 60,000-kW set represent a smaller purchase price than six 10,000-kW sets, but it also involves heavy initial capital expenditure on machines, processes and design data.

As a consequence of all these tendencies, there has been a marked check in the flow of capital into the manufacturing industry in spite of a large and steady growth of capitalisation in the supply industry. Figures given in the memorandum show the capital invested in electrical manufacture to have been almost stationary from 1905 to 1917 at about 40 millions, during which period the capital expenditure by supply undertakings rose from 60 to 95 millions. A somewhat lurid picture is drawn of what *may* happen if the consumer persists in his wicked ways, and by playing one firm off against another succeeds in securing an uneconomic price. The very limited number of firms in the country capable of handling big work may be brought together financially to form a combination under one control, after which it would be easy for such an amalgamation to form international agreements and limit competition to the very minimum possible. As an alternative to such trustification it is claimed, and supported by statistics, that co-operation among producers based on exact knowledge of the market and a more reasoned adjustment to economic changes reproduces the benefits of limitation of competition without its defects.

In the smaller products limitation of competition is difficult or impossible since they present no technical or financial obstacles to the entrance of new capital and fresh undertakings. In this group, mass production is the keynote rather than quality production, and price is the determining factor. Quality may command a slightly higher price, but seldom greater than 5 per cent. The market is a fairly steady one, trade depressions affecting it only slightly, owing to the fact that the output of electricity is moving upwards almost without interruption and all these products are necessary to the immediate consumption of electricity.

Industrial Electrification and Growing Production.

The question of power finance is then touched upon, and it is suggested that this may be of great importance in the future of the electrical export trade, and also in connection with national electrification, where capital is required for the conversion of the basic industries to electric drive. The section concludes with some notes on electricity supply from the manufacturers' point of view. It is urged that there is an optimum return on capital expenditure beyond which it is difficult to go and unwise to attempt, at least in the direction of high energy prices. It is possible to establish for a number of industries what may be regarded as an economic price for electricity, and the fact that this has not been generally quoted largely accounts for the backwardness of electrification in the basic trades. Greater capital expenditure on load building is strongly urged, and the possibility of future co-operation between the manufacturing and the supply industries is touched upon.

Chapter 2 deals with electrical manufacturing, starting with a section on production. Production on the whole has moved rapidly upwards in the last fifteen years, the 1928 figures being three times those of 1913 in value. During the last three years the curve of increase has shown a tendency to straighten out, but reasons are given for believing that this check is only a temporary one. The electrical section is easily the largest of the engineering group of industries with the exception of automobile construction, and it is actually responsible for more than one-third of the total output of all the engineering groups. During this period there has, however, been a notable change in the balance of products from heavy to light. Thus, in the period between the two Censuses of Production, 1907 and 1924, the output of generators, transformers and other power plant has trebled, but motors, cables and apparatus have increased by over four hundred per cent. Similar tendencies are even more noticeable in the United States of America, the actual figures being as follows:—

INCREASES FROM 1907 TO 1924.

Great Britain			U.S.A.		
Heavy	Light	Total	Heavy	Light	Total
360%	413%	404%	283%	572%	540%

As regards productive capacity there is no reason for the statement which has been recently made that the industry is now fully employed and cannot add easily to its existing output. Figures support the belief that the industry is in a position to increase its production by at least 40 per cent.

A more detailed analysis of the variations in electrical trade show two cycles of prosperity and depression since the conclusion of the war. In general, trade conditions appear to affect the electrical industry with a time lag of one year, but there is one section which has moved steadily upwards without check, namely, switch and control gear. Summing up, the results show that consumption has increased by 170 per cent. since 1913, production by 190 per cent., and exports by 150 per cent., whilst production for home consumption alone has increased by 210 per cent.

Costs and Efficiencies.

Tables are next given showing the distribution and increases in the various costs of production. From 1913 to 1927 the increases were as follows:—Materials, 55 per cent.; factory and commercial expenses, 72 per cent.; labour, 116 per cent.; and taxation, 570 per cent. These increases are differently distributed in the various branches of the industry, being greatest in mechanical plant and least in meters. The taxation increase is, of course, the most spectacular and leaves that of labour far behind. As regards the latter, it is noted that since 1913 the tonnage of output has increased by 80 per cent., while the total man-hours worked has only increased by 37 per cent., so that the extra wages have been offset by an improved labour efficiency of something like 29 per cent. This can be attributed largely to bigger and better tools and equipment, to higher labour and managerial efficiency, and to an improvement in the industrial load factor.

Side by side with these changes in value and in tonnage there have been certain notable technical changes. The output from a given weight of plant has gone up, particularly in the heavy plant section, and the weight per kW of turbine sets which averaged 42.5 lb. in 1918 to 1920, averaged only 14.9 lb. in 1927 to 1928. At the same time efficiencies went up, and the average generating station now has exactly the efficiency of the 25 most efficient stations in 1922-23. The average improvement in seven years has been 31.5 per cent.

Prices per ton are found from the Board of Trade import and export figures; they rose from about £70 per ton in 1904, to £270 per ton (import) and £164 (export) in 1927. The difference between the last two figures is partly due to the difference in character, the imports including a bigger proportion of small machines and apparatus.

The Prices of Electrical Plant.

Combining price per ton with capacity per ton gives the result that total prices per kW have steadily declined since 1920 and are now less than half their then values, the most marked changes taking place in machines, condensers and instruments. Comparing so far as can be done with pre-war values, the average price per kW in 1928 was about 20 per cent. above that in 1913, as compared with a 40 per cent. increase in general wholesale prices. No allowance, however, appears to have been made for the growth in the mean size of the unit. These figures are regarded as sufficient evidence that there has not been any attempt to maintain prices at an unnaturally high level, and in further confirmation the prices paid by supply undertakings are quoted. Dividing total capital expenditure on generating plant by the kW capacity gave a total of £17.1 per kW in 1923, and £15.3 per kW in 1927, whilst the capacity added during the period worked out at only £12.1 per kW.

The main conclusions as to costs and prices are summed up by saying that costs of production have gone up by 82 per cent. measured in selling value, labour costs have gone up by 116 per cent. on the same basis, and taxation by 530 per cent., but there has been an increase in labour efficiency which has helped to offset these latter increases. The course of prices of the product measured on a tonnage basis is slightly greater than the increase in values, judging by the export figures. The cost of the product when measured per kW has moved steadily downward since 1920, and in the case of heavy generating plant the reduction has been greater than the average for all electrical goods.

(To be continued.)

* "The Electrical Industry of Great Britain: Organisation, Efficiency in Production and World Competitive Position." London: B.E.A.M.A. Publication Department. Pp. 235 and diagrams. Price £2 2s. net.

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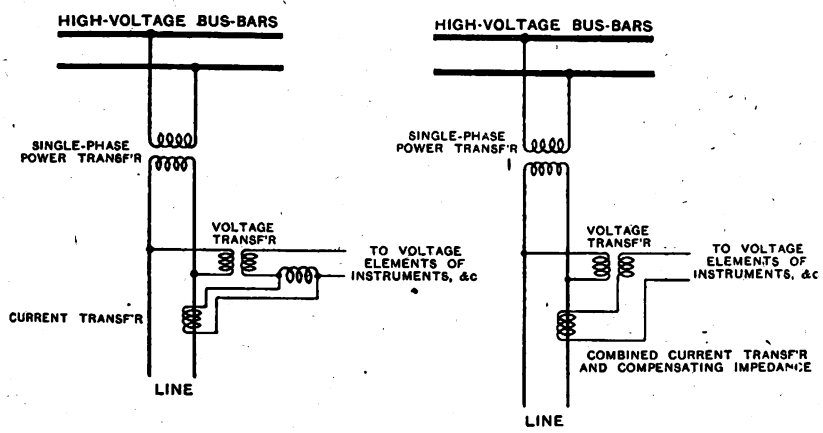
Super-Voltage Measurement.

The British Thomson-Houston Co., Ltd., has introduced a method of measuring high voltage from the low-voltage side of a.c. systems, using "compensating" circuits to reproduce accurately the primary-circuit conditions.

ON Friday last a party of engineers, including consultants to the Central Electricity Board, witnessed demonstrations at the Rugby works of the British Thomson-Houston Co., Ltd., of that firm's method of accurately measuring high voltage from the low-voltage side of a.c. systems. The application of the scheme avoids the use of super-voltage transformers by connecting



Figs. 1 and 2.—Elementary Applications of "Compensated" Method of H.V. Measurement.

voltage transformers to the low-pressure side of a power transformer winding, and also by providing means by which errors due to power transformer regulation are compensated for. An impedance is placed in each phase on the secondary side of the voltage transformer whose primary side is connected to the low-pressure side of the power transformer. The impedance has a value proportional to the impedance of the power transformer, both in resistance and reactance, and is energised by a current that is also proportional to the load current passing through the power transformer, so that the compensating circuit represents exactly the conditions in the power transformer circuit. By this means, a voltage drop is obtained across the impedance that is proportional to the voltage drop in the power transformer under any conditions of load. Therefore, the voltage drop is suitable for correcting the secondary voltage error of the voltage transformer due to the regulation of the power transformer, and thus produces a compensated secondary voltage which is a true representation, both in phase and in magnitude, of the voltage of the h.v. side of the power transformer. Fig. 1 illustrates an elementary application of this voltage-compensation scheme to a single-phase power transformer circuit. It will be observed that the compensating impedance is energised by a current transformer connected in the low-pressure side of a power transformer circuit; it is, however, possible, and more often than not preferable, to combine the impedance and current transformer in a single unit, thereby simplifying the connections, as shown in fig. 2.

It is the general practice for a super-voltage power transformer to have its windings star-connected on the high-voltage side and delta-connected on the low-voltage side. For this condition the impedance should be inside the delta of the low-voltage windings, and the voltage transformer should have its primary windings in delta and secondary windings in open star. This arrangement, of course, presents difficulties, and therefore a scheme has been evolved whereby the impedance can be connected outside the delta, as illustrated in fig. 3. It will be observed that the line current transformers and impedances are combined into single-phase units. Each unit is divided in two sections, so that the compensating impedances can be connected in zig-zag formation. Each half section is provided with an auxiliary winding excited from a current transformer connected in the neutral on the high-pressure side of the power transformer. The neutral point of the zig-zag connected impedances would always correspond to the centre of gravity of the low-voltage triangle; but this, however, would not correspond to the position of the neutral within the high-voltage triangle. The purpose of the auxiliary windings is to move, in effect, the neutral point of the impedances to a position corresponding to that of the high-voltage side. It is, of course, appreciated that the movement of the power transformer neutral is determined by the magnitude of the current flowing in the neutral, and accordingly a current transformer connected in this neutral would supply the requisite current to effect this change. Actually these auxiliary windings move the low-voltage triangle and not its neutral point, but the relative effect is the same as if the triangle were kept stationary and the neutral point moved within it. There are means by which the low-voltage neutral can be moved instead of the triangle, but such means involve complications in other directions which are eliminated by the method shown in fig. 3. It will now be readily understood that this method provides a triangle of secondary voltages with a neutral point that will under all normal and abnormal conditions of service correspond exactly to the high-voltage triangle and its neutral. In other words, the secondary voltages are always a faithful representation of the high-voltage conditions. Whether the current transformers and impedances are separate or combined into single units, the effect is always to introduce a constant value of impedance into the secondary circuit of the voltage transformer, irrespective of the compensating effect due to the load current through the power transformer. This constant impedance effect produces a ratio and a phase-angle change in the same manner as would be caused by any other impedance connected in the secondary circuit, and therefore the value of the impedances should be kept as low as possible. The only limit to this is the value of the current energising the impedances, for the lower the value of the latter the higher the current required. In order to obtain an homogeneous arrangement it is highly advisable for all the components to be designed and tested together.

The method demonstrated for "voltage-compensation" has been incorporated in every sub-station so far considered by the Central Electricity Board for the 132-kV national scheme. The "compensated voltage" so obtained is used for protective devices and for synchronising purposes. Another important order is for the application of "voltage-compensation" to the automatic regulation of high voltage generator-step-up transformer groups. It will be appreciated that the voltage applied to the voltage regulator can, with the inclusion of these "voltage-compensating" devices, be taken from

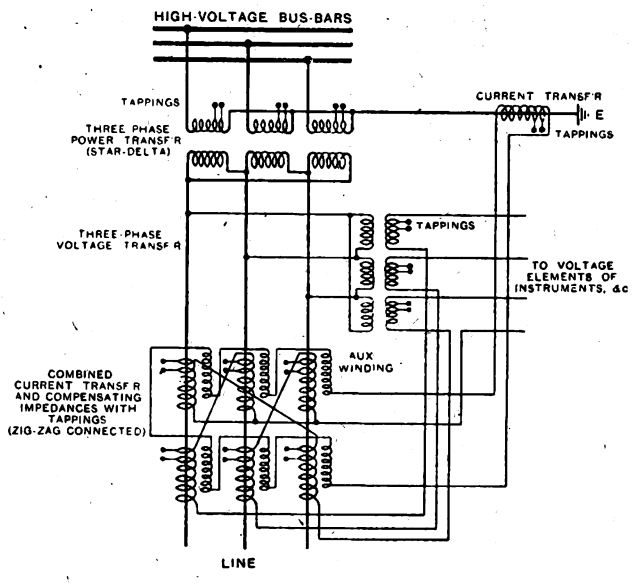


Fig. 3.—"Compensated" Connections on Three-phase Circuit.

the low-voltage side of the group. A further application for which an order has been received is for metering purposes on super-voltage circuits without the use of voltage transformers directly connected across such circuits.

The tests witnessed were representative of the actual service conditions, so far as values of the line currents and power

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transformer reactance were concerned. The voltages, however, were on a considerably reduced scale, and that enabled direct readings to be obtained of the voltages on the h.v. side, so that the accuracy of the voltage readings obtained, *via* the compensating devices could be readily checked. The rating of the compensating devices corresponded exactly with that being supplied to one of the sub-stations for the South-Eastern electricity scheme of the Central Electricity Board. It was for a 15,000-kVA transformer bank, and the currents on the l.v. side were very low, imposing the most severe conditions as regards accuracy of the compensating device. The secondary of the voltage transformer was also loaded to correspond to service conditions. The test circuit is shown in fig. 4. The power transformer was rated at 75 kVA, 660/165 volts, and 10 per cent. impedance was obtained by the use of separately mounted reactors, not shown in the illustration; this provision was necessary on account of the difficulty of obtaining 10 per cent. impedance in so small a transformer. One set of voltmeters was directly connected to the h.v. side, giving a direct reading of the line and phase volts. A second set of voltmeters was operated by the voltage-compensating device, and these instruments were scaled to be direct reading for the h.v. side, and placed immediately under the corresponding voltmeters reading direct from the h.v. side. The accuracy of the voltage-compensating device was accordingly demonstrated by comparison of the two sets of phase and line voltmeters. Further, ammeters were connected in the l.v. lines and in the h.v. neutral, and a power factor indicator was also provided to indicate the power factor of the load on the l.v. side of the power transformer.

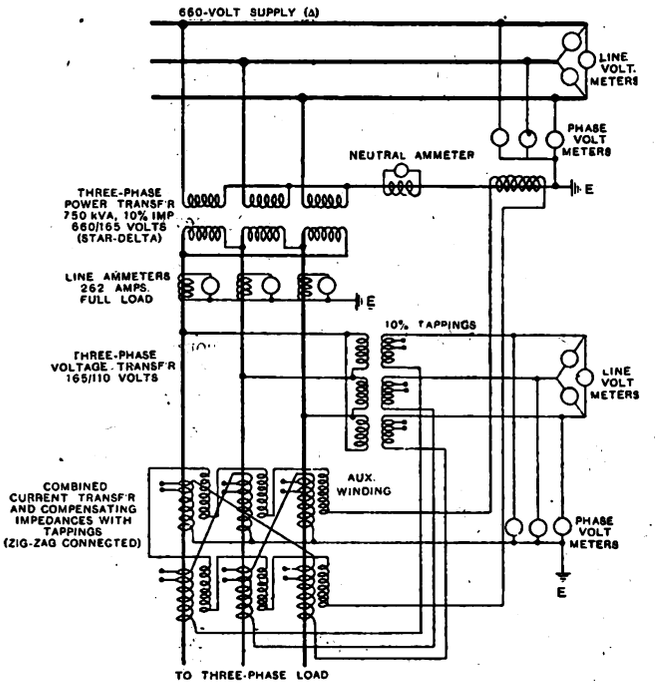

Fig. 4.—Circuit of Demonstration Apparatus.

Tests under various mains and loading conditions were taken, and the readings obtained were very convincing. With normal conditions on the supply mains and the secondary side of the power transformer "shorted" (3 lines), both the direct reading instruments and those operated *via* the compensating device read 650 V. With the compensating device out of circuit the latter instruments read zero. With the secondary side of the power transformers "shorted" across two lines the respective phase readings on both sets of instruments, line and "compensated," were 800, 700 and 650 V, with the compensation in circuit. With the supply mains "earthed" on one phase, the respective "line" and "compensated" voltmeter readings again agreed, the voltage of the earthed phase being zero and that of each of the other phases 200.

Low-temperature Coal Carbonisation.

An outline of practice in England, America, and Germany, with special reference to the combination of the process with the production of electricity.

(*Report of a joint meeting of the* INSTITUTION OF ELECTRICAL ENGINEERS *and the* INSTITUTE OF FUEL.)

AT the joint meeting of members of the Institution of Electrical Engineers and of the Institute of Fuel in London on November 21st three introductory papers were presented (in abstract) and discussed, all of them dealing with the possibilities of combining the low-temperature carbonisation of fuel with the production of electricity, the papers being indicative, respectively, of English, American and German practice.

Col. Sir Thomas F. Purves, O.B.E., president of the I.E.E., occupied the chair.

English Practice.

(Summary.)

By E. H. SMYTHE, A.M.Inst.C.E., and E. G. WEEKS.

Great Britain being dependent almost entirely upon coal for the production of electricity (the amount of water power available being comparatively small) the inauguration of the "grid" transmission system and the co-ordination of power production afford favourable conditions for combining the latter with the distillation of coal.

The Babcock process of low-temperature coal distillation is briefly described; so far as the authors are aware, it is the only process of its kind developed in Great Britain. It is suggested that the electric power plant of the future will take in coal as its raw material, but will deliver, in addition to electricity, motor spirit, fuel oil, creosote, pitch, and other derivatives of coal tar. A discussion of the actual results obtained from the coal distillation plant at Dunston-on-Tyne follows. It was designed for the production of an ideal power station fuel, low in volatiles and therefore smokeless, and for the recovery of the more valuable by-products consistent with the production of such a fuel. The broad result obtained is that 16 gallons of tar oils and ¾ ton of semi-coke are produced from 1 ton of Northumberland small coal. The authors discuss the potentialities of low-temperature tar and explain that investigation of this aspect of coal distillation is by no means complete. The field of research is said to be one which presents wide possibilities. A full description of the plant at Dunston is given as an appendix to the paper.

It is claimed that a new situation exists in which a practical process of coal distillation has been evolved in conjunction with the generation of electricity. Development has been carried out primarily for the better utilisation of the constituent parts of raw coal, but there are also the prospects (*a*) of cheapening the unit of electrical energy, and (*b*) of providing a smokeless fuel which has proved itself to be eminently suitable for burning on a large scale in boiler furnaces. A good deal of success has recently been achieved in improving the combustion of raw coal, but all the energy has been confined to that one direction. Under the new conditions, the advance which has been made will be consolidated and combined with better utilisation of the raw coal and the production of an improved boiler fuel.

The claim is based upon results obtained during three years of continuous operation under day-to-day working conditions. The plant has, moreover, two important advantages: first, it occupies little ground space, and, secondly, it can be conveniently worked in with the design of the boiler house plant of a modern power station. The further conditions of reasonable first cost, reliability, and low working cost, have also been met. Details of first cost are not included in the present paper.

Having regard to the practical and technical efficiency claimed for the process, progress made up to the present time, measured in terms of the tons of coal distilled per day, is disappointingly small. The fact must be admitted, but the explanation is fairly simple, for new industrial processes are notoriously slow in establishing themselves against old and well-tried methods.

American Practice.

(Summary.)

By S. MCEWEN, A.R.S.M., F.Inst.F.

Consideration is given to the possibility that the pre-treatment of coal with the recovery of by-products may secure an economic advantage in the production of electricity in the United States of America. Reference is made to the trend of of opinion of power station engineers and to the great interest which is maintained in the subject.

The economic possibilities are reviewed, and stress is laid on the necessity for securing maximum revenue from the sale of such gas as is produced by the process of pre-treatment, and it is claimed that this result can be obtained only by

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co-operation with public service companies supplying gas to domestic and industrial concerns.

The installation of the McEwen-Runge process at the Lakeside station of the Milwaukee Electric Railway & Light Co. is described, and an account is given of its development so far as it has been continued in America, the earlier experimental work, which originated in England being omitted. Particulars are given of the progress which has been made, together with an indication of the direction which future development will follow.

It is desirable that the economic possibilities of the pre-treatment of coal should be realised and the conditions which are essential for commercial success should be clearly understood, for a process which is both technically and commercially successful when applied to domestic fuel might not be commercially successful if the solid fuel were utilised for power production instead. Fuel for the former purpose can be sold at a high price, generally very much higher per unit of weight than that of the coal from which it was produced, but the power-station engineer is more concerned with heat units; he is not so much concerned with the physical condition in which the fuel is supplied to him. The revenue obtained from the sale of the liquid and gaseous by-products has to pay the whole cost of pre-treatment and, after an allowance for the loss of weight of the solid residue, as compared with the original coal, provide an adequate profit to warrant the undertaking. It is for this reason that a low-temperature process operated in conjunction with a plant for electric power generation has a much smaller margin for profit than is the case with low-temperature processes which yield, as one of the main products, a high-grade domestic fuel.

It may be said that it is not necessary to develop a low-temperature carbonisation process in order to give effect to an alliance between electric power and town gas undertakings, and it is possibly doubtful whether so much interest would have been taken by power-station engineers in low-temperature carbonisation were it not for the fact that the coke produced by high-temperature processes is not favoured by power-station engineers as a fuel. The justification for the development of low-temperature carbonisation in this connection lies in the fact that semi-coke is an ideal fuel for combustion, while the net revenue from the by-products of a low-temperature process promises to be greater than that from the by-products of a high-temperature process.

In designing the McEwen-Runge process the objective aimed at was a system which would have a very high capacity per unit, could be constructed cheaply, and could be operated with a minimum of labour; it was further decided that it would be necessary to produce town gas for sale. The process consists in carbonising pulverised bituminous coal while that coal is in suspension in a hot gas. In practice the pulverised coal from the ordinary preparation plant of a pulverised-fuel-fired power station is intercepted on its path from the preparation house to the boiler house and is allowed to fall by gravity in a shower through a vertical tower up which heated gases rise, so that there is an exchange of heat from the gases to the coal, with the result that carbonisation is effected. By this system it is possible to reduce the time normally required for carbonisation from hours to seconds, making it possible to secure very high capacity from a relatively small plant. The resultant carbonised residue, being still in a finely-divided condition, is available for supply to the boilers where it can be burned as pulverised fuel.

For the pre-treatment of coal in conjunction with power generation it has been said that the plant should be capable of being operated at varying capacity to suit the hourly demand for power, or, alternatively, that pre-treatment plant could only be applied to a base-load power station. This, however, is scarcely the case, since the pre-treatment plant can be operated at a uniform capacity per day of 24 hours, variations in demand for power being provided for by storage bunkers, for the pulverised semi-coke can be stored indefinitely and is unlike pulverised raw coal in this respect. The variation in demand for town gas, which follows very closely the variation in demand for electricity, can also be provided for by adequate holder capacity. Seasonal variations can, of course, always be allowed for by having a sufficient number of units in the pre-treatment plant, one or more of which can be put out of commission during the season of light load.

It is an interesting fact that at the present time in the large American towns the demand for gas and the demand for electric power bear such a relation to each other that the demands are met by the yields of gas and power which it is possible to obtain by the pre-treatment of coal.

German Practice.

(Summary.)

By PROF. P. ROSIN, DR.ING.

The paper deals with the economics of the production of power and valuable by-products from brown coal, which is very plentiful in Germany, but has an extremely low calorific value. The pit coal is similar to that in England, whilst brown coal is very inferior until it has been treated in order to improve its quality. It contains from 50 to 60 per cent. of water and from 3 to 10 per cent. of ash, and its calorific value is only about 1,800 to 2,500 kg.-cal., but it can be obtained so cheaply from very large open workings that its cost per calorie at the mine is much lower than that of pit coal. On account of its high water-content the transport of raw brown coal to any distance is uneconomic; therefore, it must be dried and converted into briquettes containing about 15 per cent. of water, whereas the transport of pit coal over long distances is rendered possible owing to low railway tariffs and favourably situated water-highways. For these reasons the production of electricity in Germany proceeds along two different lines: first, there are the pit-coal power stations in the coal-bearing areas themselves, and in all those districts where no other economic fuel is available; that is, at the collieries and in most of the municipal electricity works; secondly, there are the brown-coal power stations in the immediate vicinities of the large open workings being developed under Government or industrial control for overland distribution. As most of the German power houses have to operate with cooling towers, and as there are enough small rivers in the neighbourhoods of the brown-coal districts to supply sufficient water, the main consideration in the planning of steam power works is the transport of fuel and electricity. On account of the low cost of production of brown coal, the works using it have in recent years gained a considerable advantage over those dependent upon pit coal. Whilst only 23 per cent. of the electricity produced in Germany during 1914 in public works was generated from brown coal, the percentage had increased in 1922 to 41 per cent., and at present is probably over 60 per cent.

The total production of public electricity works in Germany in 1928 increased to approximately 14,500 million kWh. A similar amount is being produced each year in industrial power plant, so that the total production in Germany this year will probably exceed 30,000 million kWh, corresponding to about 500 kWh per head of the population. Of the 30,000 million kWh referred to, the public and industrial brown-coal stations produced about 10,000 millions, and for this purpose consumed from 25 to 30 million tons of brown coal. The six most important German electricity works using brown coal produced some 6,000 million kWh per annum, the plant installed in them being of 2,050,000 kW capacity, and consuming from 18 to 20 million tons of raw brown coal. The tendency in Germany is to concentrate production in large stations. Although the production of brown coal already amounts to 170 million tons a year, it will be available in Germany for several hundred years as a cheap fuel, whilst the cost of mining pit coal will probably become greater on account of the increasing depth from which it must be obtained and the fact that underground working is becoming more expensive. The country is entirely devoid of natural oils, so that the study of low-temperature carbonisation is of as much interest to Germany as it is to England. New large low-temperature carbonisation plants which have attained full production are, taken together, now treating about 3,000 tons of raw brown coal per day, and the first really large low-temperature plant in the world has started in Wölfersheim. It was originally intended as a means of producing oil, tar being the main product, whilst the semi-coke and gas were regarded as by-products. This view has undergone a complete change on account of the many economic failures of processes using German coal, which does certainly not contain sufficient tar for its sale alone to cover the cost of carbonisation, and the author believes that this is true for all countries except for Cannel coal, which is, however, only found in small quantities. The profit on the low-temperature carbonisation of pit coal must therefore be derived from the sale of semi-coke; besides being a smokeless lump fuel, it sells as artificial anthracite for domestic purposes at much higher prices than those obtained for raw coal. The economic utilisation of the gaseous products is now attracting considerable attention, but has not assumed any practical significance in Germany. Co-ordination between low-temperature distillation and the production of electricity is only remunerative, generally, if, on account of the revenue derived from carbonisation, the cost per unit becomes less than when the most reasonably-priced fuel the electricity works concerned can purchase is used. This means that the initial cost of the complete combustion plant must be so low that the semi-coke which is burnt under the power-station boilers will be cheaper than any other competitive fuel the power works could use. No power station will ever pay the same price for semi-coke as will the domestic market, and it does not necessarily require a large smokeless fuel, as it could probably purchase those classes of coal which are unsuitable for low-temperature carbonisation at a price lower than that which the carbonising plants would have to pay for their supplies. An electric power station combined with a carbonisation plant using pit coal can therefore only be considered economic if a non-coking coal contains so much tar and gas that its sale would cover all the capital charges and working expenses of carbonisation, besides leaving an adequate profit without any increase in the fuel costs to the boilers. Hitherto such pit coal has not been found in Germany, and for that reason German pit-coal carbonisation power stations cannot be operated on a remunerative basis until the initial costs of the carbonising plant have been reduced to a fraction of those obtaining at present, or until totally different price conditions obtain in the oil market.

The low-temperature carbonisation of pit coal in Germany is at present only possible for the production of semi-coke for domestic purposes, and the plant at the Mathias Stinnes colliery at Karnap is the only large plant working economically in Germany; it operates on the K.S.G. (Kohlenscheidungs-Gesellschaft) system, similar plants having also been erected, or being in course of construction, in England and America.

The independent pit-coal carbonisation plants known to the author cost on an average £250 per daily ton of raw coal

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through-put, one ton yielding about 16 cwt. of semi-coke, the calorific value of which is approximately 7,000-kg.-cal. If the power station operates with the highest fuel economy, 1 kg. of semi-coke will at most produce 2 kWh, corresponding to 1,600 kWh per ton of carbonisation coal. The installation of a carbonisation plant in connection with a power station therefore means an increased capital cost of at least £3 5s. per kW installed, but in most cases even more. The whole of the charges due to this extra capital cost, together with the working expenses, would have to be covered by the profit derived from the tar and gas. For this reaeson all the important projects relating to low-temperature carbonisation power stations using pit coal in Germany have had to be postponed, as they offer no prospect of remunerative operation at present, and only in special cases could non-independent carbonisation plant directly connected to boilers be considered, the capital cost of which would not have to exceed about £75 per installed daily ton of raw coal through-put.

The position as regards German brown coal is, however, quite different, the tar and not the coke being the main product of carbonisation, as the value of the tar is more than 2½ times that of the coke. The carbonisation must be preceded by some drying process and, as the raw coal is broken up previous to drying and breaks up still further during the carbonising process, the semi-coke obtained will all pass through a 10-mm. mesh screen. The whole of the ash of the raw coal is transferred to the semi-coke, so that the ash content of the coke is between 20 and 40 per cent., but it is a free-burning smokeless fuel. It has, however, a great tendency to self-ignition. The gas has a calorific value of 4,000 cal. per m.³, but in this condition it contains up to 40 per cent. of CO_2 and 10 per cent. of H_2S. If purified its calorific value is 8,000 cal. per m.³.

In 1928 about 2½ million tons of brown coal was carbonised, giving 522,000 tons of semi-coke. This year a 20 per cent. increase is to be expected. This year no new carbonisation plants have so far been built or ordered in Germany; after some years of rapid expansion it is now necessary to call a halt, during which the newly erected plants must be adjusted for efficient operation and a close study of detail made. At the same time, the development of the market conditions has to be awaited and the effect of the sudden increase in production noted. Whilst the future development will be favourably affected, owing to the fact that the new hydrogenating processes enable brown-coal oils to be transferred in bulk into motor spirit, the position is not yet clear as to what effect the increased production of paraffin will have on the German market, which is now almost saturated by the present output. On the other hand, the gas produced has now been successfully purified by the elimination of CO_2 and H_2S, due to pressure washing, so that it can be used for town gas supply. The Edderitz mines near Koethen are now supplying the surplus gas from the carbonisation plant to Dessau for the Continentale Gasgesellschaft, which is the first long-distance gas transmission of this kind and has been in successful operation for several months. The marketing of the increased quantities of semi-coke produced by this means has now become a difficult problem. This fuel is used in special stoves in small amounts for domestic purposes more particularly by the poorer classes of the population. This source of disposal, however, cannot be further developed; it has, in fact, decreased somewhat in recent years. It has not, so far, been possible to make briquettes from brown-coal semi-coke on an economical basis, and the gasification of the very fine coke breeze containing a high percentage of ash is also a difficult matter. It is, therefore, necessary to endeavour to introduce it as an industrial fuel for steam boilers or furnaces, and recently suitable travelling grates have been constructed which give successful results. The burning of the coke in pulverised form can only be satisfactorily adopted if the coke is dry-quenched, as wet coke cannot be pulverised and the re-drying of it increases the cost beyond economic limits. Dry quenching obviates at the same time the dangerous tendency to self-ignition; even so, the pulverising of brown coal semi-coke is by no means easy, as the output of the mills is less than when raw coal is being ground, in addition to which the wear and tear is very heavy.

The use of the new large carbonisation plants calls for an immediate solution of the problem of waste liquor disposal, containing as it does sulphide of hydrogen, phenols, and fatty acids, in addition to ammonia. This waste liquor cannot be run to waste unpurified, but the author's recent work has shown one way of purifying it and removing the phenol content.

The necessity of reducing capital cost and working expenses is daily becoming more obvious, as the coal deposits which are rich in tar and can be obtained cheaply in open workings are now becoming exhausted. It is therefore necessary either to carbonise the brown coal containing a low percentage of tar which is available from open workings, or to adopt mining methods for obtaining the richer brown coals, in which case the cost is fully twice as great. The cost of the raw material is the most important factor to be taken into account in estimating the earning capacity of a carbonisation plant, particularly as the fuel contains 50 per cent. of water, which must be removed.

The capital cost of a new raw brown-coal power station in Germany is about £12 10s. to £15 per kW installed. The addition of a carbonisation plant would increase this capital cost by approximately £12 10s. to £17 10s. per kW, depending within these limits on the yield of semi-coke, its calorific value, and the consumption of the power plant to which it is attached. On account of this high extra capital cost only base-load power stations can be considered as suitable for such combinations. Assuming that such a plant operates for 3,500 hours a year, a tar yield of 7 per cent. from the raw coal makes the revenue from electricity about twice the tar value, on the basis of present tar and energy prices. In this connection it must also be remembered that the price of energy is much less subject to fluctuation than the price of tar. The market price of electricity is, in all probability, the most stable of all market commodities, whilst the oil market is subject to violent fluctuations. For this reason the profit from a carbonisation power station must be built up in the first place on the basis of the supply of electricity, which must be ensured in such a manner that fluctuations in the price of oil would not endanger the general economic stability of the works.

Theoretically, extraordinarily close coupling of the individual portions of the plant is possible, enabling an exceptional economy of fuel to be obtained, together with full utilisation of nearly all the products in a reciprocal manner. In practice, however, the coupling should not be on too rigid lines, even at the cost of a somewhat higher heat consumption. Difficulties are unavoidable in all plant, and the resultant losses affecting all branches of the works are not necessarily counterbalanced by the attainment of the highest possible thermal efficiency. For this reason, carbonisation power plant should, in the first instance, be a combination of carbonisation and power production from the point of view of space and profit, the operating standpoint of the combined plant being a secondary consideration. This principle will have even greater significance when the coupling becomes a triple one, that is, when carbonisation plant, power station, and gas works are combined, to which end Germany is at present making preparations.

Discussion in London.

Most of the speakers in the subsequent discussion congratulated the authors on the candid manner in which they had dealt with the two processes in use in England and the U.S.A. and the general situation in Germany.

Mr. W. M. SELVEY, who opened the debate, as a member of both Institutions, voiced the Institute of Fuel's appreciation of the joint gathering, remarking that such meetings were becoming increasingly necessary. He drew attention to the need for the co-operation of the industries interested in the subject under discussion, which could be between (*a*) power + chemicals, (*b*) power + chemicals + gas, (*c*) power + chemicals + gas + domestic fuel, with a view to the provision of a "common financial umbrella." Such combination was possible in the U.S.A., but not in England, where statutory undertakings operated, unless a new spirit was born. It was significant that, although the Dunston plant was situated in Durham, Northumberland coal was used. The process resulted in the up-grading of fuels and also of the gas produced.

Dr. A. T. DE MONILPIED expressed the opinion that, while at present the gas produced was regarded as the most profitable commodity, ultimately the oil product would be the most important. The semi-coke gave more radiant heat than the original coal, and tests of the main boiler at the Worcester Corporation electricity generating station had shown that its use resulted in greater evaporation, higher furnace temperature, lower flue-gas temperature, and smaller sulphur content, which considerations should influence the situation materially.

Dr. C. H. LANDER thought combination would ease power production by enabling the design of cheap plant of a large through-put, but the economic aspect was not so clear, as the power producer would lose if there was no union between electricity and other industries. The process did not result in any appreciable increase of the commodity value of the solid fuel and gas produced, so only the oil was left if a price could be got for it. His staff had tested the Dunston plant and, although the report had not yet been issued, he could confirm the authors' figures. It had been said that coke made in externally-heated retorts was more difficult to burn, as it became graphitic, which term meant nothing at all. X-ray examination had indicated the presence of the so-called graphitic characteristic in all specimens, but there did appear to be some parallelism with the size of the colloidal molecule.

Mr. NIELSON said that in the McEwen system it seemed to be wrong to grind the coal first, which involved grinding also some 30 per cent. of unwanted residue. It should be carbonised first, then quenched if desired, and ground afterwards. He had been told that in Germany some difficulty had been caused by the growth of cast iron closing up the corrugations of the coke-supporting and extracting gear in the retorts.

Mr. S. MCEWEN, in reply, stated that, while semi-coke had many advantages as a fuel, he could not claim that its fuel value per B.th.u. was higher than that of coal. The reason why the coal was ground first was because the heat transmission was thereby made more rapid at a low temperature head, resulting in the carbonisation time being reduced from hours to seconds.

Prof. P. ROSIN explained that retort trouble had been overcome by the use of steel in place of cast iron. He briefly outlined his method of removing the phenol content of the waste liquor.

Mr. E. H. SMYTHE said that the external heating of retorts was the only subject touched on in their paper of which they had no personal experience, but their remarks were based on serious experiments made in Germany.

Mr. E. G. WEEKS said that all their experiments were made with non-coking coals. He could not claim an increase of evaporation due to the use of semi-coke.

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New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

A New Floodlight Fitting.

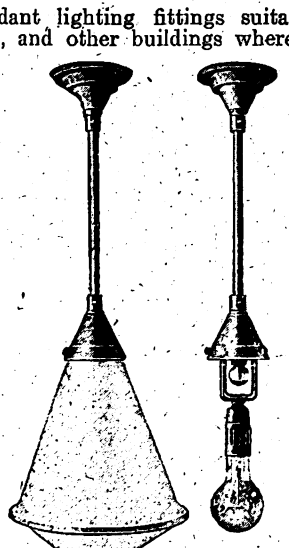
The floodlight fitting depicted in fig. 1 was exhibited for the first time at the recent conference of the Association of Public Lighting Engineers at Bournemouth. It is a product of METRO-VICK SUPPLIES, Trafford Park, Manchester, and is built with a view to providing a lighting unit giving ample and evenly diffused illumination conjunctly with high

Fig. 1.—M.V. "Floodray."

efficiency and mechanical strength. It is claimed to be completely weather-proof, and adequate provision is made for the dissipation of the heat generated by the lamp.

A New Lighting Fitting.

Pendant lighting fittings suitable for hospitals, nursing homes, and other buildings where a subdued light or emergency lighting is desirable, have recently been introduced by KORTING & MATHIESEN ELECTRICAL, LTD., 711 and 715, Fulham Road, S.W.6. These fittings are provided with two lampholders, one B.C. or E.S. for the larger lamp providing general lighting, and one B.C. holder wired independently for a smaller wattage lamp (10-15 watts). The metal parts are finished white enamel, and the rod of the pendant fittings is dull nickel plated. The smaller lamp will provide, if suitably wired, a pilot light which may also be used as emergency lighting if connected to an independent source of supply. The upper globe is of clear glass, satin finished, and the lower bowl of opalescent glass; the greater portion of the light is thus directed on to the ceiling and reflected, avoiding glare. The fittings are provided with two standard lengths of pendant tube, *viz.*, 16 in. and 32 in. There are two patterns, No. 665 being for lamps of 60-100 W and No. 654 for 100-200 W. The accompanying illustrations, figs. 2 and 3, show pattern 654 complete and with the globe removed.



Figs. 2 and 3.—The "Pilolite" Fitting, Complete and with Globe Removed.

An Anti-dazzle Lamp Lens.

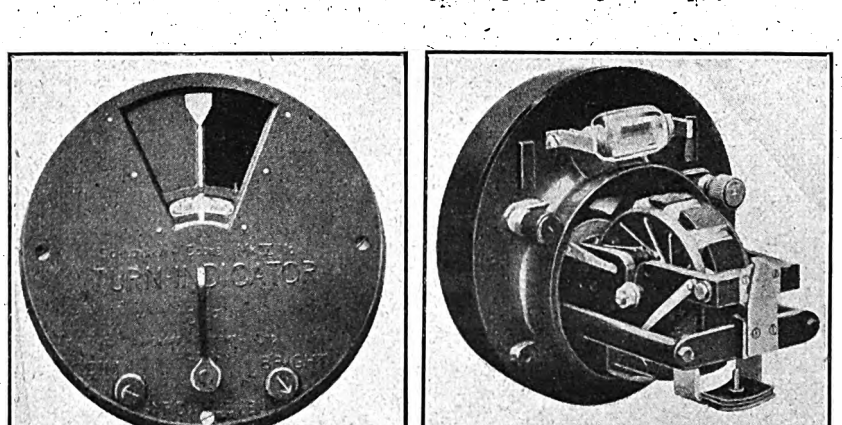
A recent introduction of the EARTHING CLIP CO., 71, Hatherley Street, Princes Road, Liverpool, is an anti-dazzle motor lamp lens which can be fixed into any existing lamp in a few minutes, and thereby make it glare-proof. The electric lamp is visible through the lens in a magnified form, and is controlled by a combination of prisms, which, it is claimed, completely absorbs the dazzle.

A New Flexible Coupling.

The POWER PLANT CO., LTD., West Drayton, Middlesex, has recently introduced a new flexible coupling, the design of which is claimed to offer many points of interest. It is an all-metal flexible coupling in which the elastic elements consist of straight spring-steel bars which are mounted in a carrier ring, the ring in its turn being freely supported on a spherical extension of one of the coupling bosses. The ring can accommodate itself to mis-alignment, either of off-set centres or inclination of shafts. The coupling is fully lubricated by grease under pressure, and performs its work silently and with extremely little wear to the working parts.

A Gyroscopic Turn Indicator for Aeroplanes.

An interesting device on view at the recent Aviation Exhibition at Olympia was the Schilovsky-Cooke electrical gyroscopic turn indicator for use on aeroplanes which has been introduced by AIRCRAFT PATENTS, LTD., 4, Broad Street Place, London, E.C.2. The maintenance of an accurate course while flying through clouds, on dark nights, or over the ocean when no horizon is distinguishable is largely dependent upon the use of a device of this kind. It is of course possible to fly in these conditions with the aid only of the air speed indicator, lateral bubble level, and compass; but such flying makes great and harmful demands upon the pilot's concentration. The Schilovsky-Cooke turn indicator, figs. 4 and 5, is designed to expose a band of red light when the aeroplane turns to the left and a green light when it turns to the right. The extent of the light exposed indicates the rate of turn, small deviations being indicated by a narrow slit of light. The instrument is luminous, so that it can still be read if the lamp fails. The gyroscopic principle is employed in the instrument, the gyro wheel consisting of a small electrically-driven armature mounted on ball bearings and running at about 1,200 r.p.m. The apparatus is operated off the aeroplane lighting battery, the current required being only 0.8 A, 12 V, by day and 0.6 A by night. A special damping device prevents



Figs. 4 and 5.—Front and Rear Views of Schilovsky-Cooke Indicator.

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the instrument from signalling the slight regular swing from side to side common to most aeroplanes. It consists of an arrangement of air dashpots, one taking charge of the gyro and another of the cross level screen. The apparatus measures 5 in. by 4 in. and weighs just over 2 lb.

An Electric Paint Stripper.

The Electric Heating Co., George Street, Croydon, has just put on the market a very simple, but useful, appliance for stripping paint off doors and boards.

The "Elect" electric paint stripper consists of an electric element enclosed in a casting of Admiralty brass having a bottom plate of steel. The loading is in the neighbourhood of 80 watts. The bottom plate is brought to a sharp edge, and should this by accident come in contact with a hidden nail a new plate can be fixed at the cost of a few pence. From the element running up a steel tube into the handle, which, by the way, is set off from the cast element chamber to prevent the hot paint falling on to the hand when in use, are the connections which are protected by fish spine beads, the ends of the leads being connected to the terminals at the top of the handle; from these terminals a light but strong tough-rubber flexible is fitted of about 16 ft. in length.

The stripper is constructed in such a manner as to reduce labour to a minimum. No advantage is gained by forcing the tool along the surface to be cleaned; hardly any pressure need be applied to the mouldings, which owing to their construction cannot be stripped of paint, but can be ironed with the stripper tool and followed immediately with an ordinary shave hook. The angle at which the stripper is held against the paint depends entirely on the thickness of the coat to be removed, also the condition of the paint, but to find the angle is by no means difficult and a few runs over the paint will soon reveal which angle is best.

A Fuse-Wire Container.

Messrs. McNair Kirk, 595, Dumbarton Road, Partick, W., have sent us a sample of the "Reddy" fuse-wire container, fig. 6, which they have just introduced. It measures 2½ in. by 2 in. and contains two separate fuse-wire spools, which are totally enclosed and from which the wire is drawn through bushed holes in the container. The ends of the case are removable, so that refills can be inserted with ease. "Before renewing fuses, main switch must be placed in off position" is a useful caution carried on the device.

An Electric Graining Machine.

Messrs. Guy V. Laycock, Ltd., 12, Cloth Hall Street, Manchester, have recently introduced an electric graining machine for use in the decorating trade. It is claimed that this machine has been subject to tests extending over two years, and that it has been proved to be the quickest and best method of mechanical graining yet introduced. In the hands of a skilled grainer a surprising amount of work is accomplished in a very short time, and the results are not only pleasing from an appearance point of view, but are permanent, as the cutters engrain or "tattoo" the wood. The machine can be held in the hand for long periods without fatigue, and it is efficiently earthed in accordance with Home Office requirements. A sand-papered wheel can be attached in a few seconds, and this is particularly suitable for awkward corners, fillets, and so on.

An Electric Drink Mixer.

The accompanying illustration, fig. 7, shows the new No. 10 electric drink mixer which has been introduced by Messrs. S. G. Leach & Co., Ltd., 26-30, Artillery Lane, and embodies many improvements. A special feature is the simplicity of operation. The cup slides comfortably along the column, and the motor starts instantly. Of particular importance as a selling point is the beauty of the design and finish. The standard finish is white enamel, but the mixer can be supplied in jet black, jade green, or ivory. A No. 2 mixer embodies similar features, but is finished in nickel-plate.

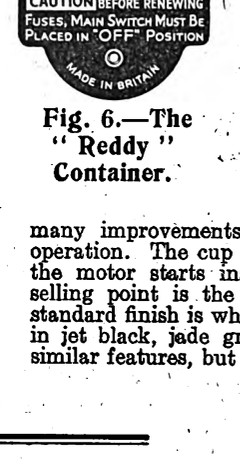

Fig. 6.—The "Reddy" Container.

Fig. 7.—A "Leach" Drink Mixer.

Standard Intermediate Voltages.

A discussion of the relative merits and de-merits of various intermediate voltages from the point of view of rural electrification.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

(*Report of a meeting of the* Overhead Lines Association.)

VOLTAGES of 132 kV and 33 kV have been standardised by the Central Electricity Board and 400/230 volts by the Electricity Commission. In order to obtain cheap supplies of material for rural electrification work it is essential to standardise one (and one only) intermediate voltage, so as to encourage the mass-production manufacture of switchgear, transformers, &c. The need for a standard is of considerable importance both to manufacturers and to electricity distribution undertakings.

For many years intermediate pressures have been adopted that permit of economical tapping for the benefit of small and isolated consumers, and thus avoid the prohibitively expensive and unwise method of tapping the main e.h.p. lines. The intermediate pressures started at 1,100 volts, gradually rising to 2,200 and 3,300 volts, air-break switchgear only being employed. At the latter pressure a very considerable amount of work has been done, resulting in the adoption of 6,600 volts without any untoward trouble or resource to oil-break switches. Later experience justified 11,000 and 15,000 volts; in fact, air-break switchgear is now utilised in connection with many miles of 33,000-volt lines.

As well as the necessity of serving isolated consumers, there is also the seasonal demand of those consumers for the operation of large threshing machines, stone breakers, electric ploughs, &c., which can of course only be economically supplied if the sectional area of the transmission-line wire has not to be unduly increased above that required to comply with a reasonable margin of safety for mechanical strength. The higher intermediate voltages permit of this, and are generally used in conjunction with portable transformer wagons equipped with meters, switch, and protective gear. While permanent connections to intermediate-pressure lines are quite satisfactory, some further investigation is needed in connection with temporary tappings suitable for the above-mentioned transformers. A recent example of this class of tapping for a 15,000-volt line is illustrated in an article by the author which appeared in the Electrical Review of November 8th, page 805.

In connection with a large rural electrification scheme with which the author is associated, he came to the conclusion, bearing in mind British regulations and prejudices, that 6,600 volts might advisably be adopted as the intermediate voltage, more especially as there was so much practical experience

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to justify and support that selection. But, upon taking the matter up with various manufacturers, there seemed to be little hope of obtaining British-made material at a reasonable price, since makers had to be prepared to supply the requirements of various undertakings over a range of voltages, resulting in the orders for any one voltage not being sufficient to justify mass production.

As a result of the author approaching the British Electrical Standards Association, its Electrical Industry Committee met on October 1st, 1929, and considered whether the list of standard voltages in B.S. Specification No. 77, Clause 5, could not be reduced in numbers for use in this country, and also whether it could make a definite recommendation for an intermediate voltage. The Committee did not feel that 6,600 volts was sufficiently high to be established as a standard, as it was quite convinced that satisfactory air-break control gear could be obtained for 11,000 volts, and it referred the matter to the Technical Committee on Voltages. Since then the writer has been informally informed that the British Electrical Standards Association has definitely decided, with the approval of the Electricity Commission, to recommend 11,000 volts, as both it and the Commissioners are satisfied that it is no longer necessary to use oil switchgear for that voltage, with which the author concurs, though he had feared to make such a radical proposal himself in case the whole suggestion might get quashed.

That voltage can be used for both distributors and feeders, and villages can be linked up and lines extended without troubling about sections; it will also serve areas nearly three times as great as will 6,600 volts. The difference in cost of the overhead-line material and air-break switchgear, as compared with 3,300-and 6,600-volt gear, naturally varies for each item; for instance, in the case of hand-operated air-break switchgear and fuses, 6,600 volts is the lowest pressure for which they are now normally designed and the saving, as compared with 11,000-volt gear, would seldom exceed ten per cent.; in fact, in the majority of cases it would probably be less. Poles and many other item costs would be unaltered and the extra cost of insulators need not be great. Whatever voltage is employed, the material has to be of a certain minimum robustness, so that the difference in actual size of insulators does not make so much of a difference in total cost as might be expected. Further, if 11,000 volts is recognised as a standard, the price of switches, transformers, &c., would fall to an economic level, since they would be produced by mass-production methods. The opinions of manufacturers on 11,000-volt air-break switchgear are also optimistic. The insulators specified are in excess of practical requirements, though they accord with the British Engineering Standards Association's standards; hence the price is higher than is really necessary, in spite of which most of the large manufacturing firms are now supplying suitable air-break switchgear for 11,000 volts, and one firm already makes air-break switchgear for use on 33,000-volt transmission lines. 11,000-volt generators are now being used in connection with urban supply; hence the extension of supplies from urban to rural areas will be accordingly facilitated if this standard voltage is adopted for overhead-line work.

Discussion.

Mr. F. H. CLOUGH expressed himself in favour of adopting 11,000 volts. The question of insulators might be determined largely by bird clearances, but that should not add very much to the cost. Transformers might be a little more expensive, but that extra cost might be offset by standardisation.

Mr. W. P. GAUVAIN also supported the suggestion to standardise 11,000 volts. He had had considerable experience of rural electrification in New Zealand; when that work was started the main voltage decided upon was 110,000 volts and the others adopted were 33,000, 11,000, 6,600 and 3,000, but the conclusion was soon reached that 3,000 volts was not economic, and 11,000 volts had been adopted in conjunction with the 33,000-volt lines, not only for feeders, but also for distributors. It was a little more expensive than 6,600 volts or 3,000 volts, but the line had a much larger capacity. From the point of view of mechanical considerations care should be taken that 11,000-volt lines should not be smaller than 7/.064, which was a Government regulation in New Zealand. There had been breakages when smaller lines had been used. Switchgear for 11,000 volts apparatus could be produced cheaply, even in New Zealand where everything had to be imported, and therefore it should be cheaper in this country. In New Zealand a very satisfactory 11,000-volt single-throw switch was produced for between £11 and £13, including the operating gear, which was bolted on to the side of the pole 7 ft. or 8 ft. above the ground. There was not a great deal of difference between the costs of 11,000-volt and 3,000-volt transformers. He did not agree with Mr. Matthews that failures of 3,300-volt lines would be less than of 6,600- or 11,000-volt lines, or that bird trouble would be less serious. Indeed, he was inclined to think that bird trouble would be more serious at the lower voltage, because insulator spacing was closer.

Mr. A. L. STANTON said that usually when a 6,600-volt line was erected, it was arranged to take 11,000 volts ultimately, and therefore he agreed that 11,000 volts should be adopted as the standard for the purpose mentioned. Electricity supply in this country had been too much dry nursed hitherto. They seemed to be afraid of voltage, but the fact was that experience of high voltage in other countries entirely contradicted the suggestion that there were greater risks with it, yet the regulations in this country carried that implication. Modern switchgear and transformer design enabled one to strike a good compromise and adopt 11,000 volts, at any rate until they learned what development was going to be like in future.

Mr. RUDKIN explained that in Switzerland they started with 3,000 volts, and had gone up to 10,000 volts after having tried 6,000 volts. In some cases 15,000 volts had been adopted, but generally 10,000 volts was the standard for rural distribution work, and it had enabled manufacturers to standardise their designs and reduce the cost of apparatus. To adopt any other voltage would be equivalent to going back 20 years. The cost of the line was not serious; it was only a matter of the cost of the insulators, and it must be remembered that the high-voltage line had a greater capacity.

Mr. TRENCHAM said that without necessarily suggesting that 11,000 volts would be an incorrect one to adopt for rural electrification—certainly the trend of opinion was in favour of it—he would like to draw attention to another aspect of the matter. It seemed to him that the correct voltage to adopt for any particular area must be a function of the density of the population, so to speak, to give a sufficient number of feeding points at 33,000 volts and sufficiently close spacing of the feeding points. The 6,600-volt switchgear made in this country was virtually designed for 11,000 volts, because it had not been found economic to standardise two lines of apparatus so close together. Whether that condition applied to overhead work in rural areas was a matter that might profitably be investigated. In a dense area where the distribution lines were close together there was the possibility of fairly severe faults occurring. In other words, if it were possible to lay out rural lines so that feeders were inherently limited as to their short-circuit capacity, that would enable apparatus of a light character to be used, so that the capital cost could be reduced. Voltage standardisation could only be regarded as a first step, and it should be followed by a consideration of the short-circuit conditions, so that the cheapest possible type of apparatus could be used. In that way it might be possible to produce a switch of the "ironmonger" type which could be fixed quickly and safely.

Mr. EDWARDS, who supported the suggestion that 11,000 volts should be standardised, thought the great tragedy of electrical matters was the fact that the general public was not better informed. The public became nervous when it heard about high voltages, and it would be an advantage if there were some organisation which could counteract the propaganda that was going on against the development of electricity.

Mr. THEODORE STEVENS (the president) did not know whether the objection was to high-voltage lines near towns. Personally he did not see why such lines could not be taken away from those parts where they were considered offensive, if they were offensive to the public. On the one hand, expert evidence had been given in the House of Lords by Mr. C. H. Merz and Major Richardson, supported by Sir John Snell, that the water power of Scotland should be developed and that it would be possible to transmit 50,000 kW a distance of 50 miles at a cost of 0.4d. per kWh. On the other hand, Mr. Fladgate had said he was absolutely stumped when trying to transmit 10 miles, whilst Sir Harry Renwick represented a company which transmitted from London to Rochester and was able to pay a dividend. There was something wrong somewhere, but, if transmission could be carried out so cheaply in Scotland, why should not the lines be lengthened a little in the London area, and the sulphur carried to where it would not affect London and so meet the requirements of those who took an interest in amenities?

Mr. E. W. DICKINSON (Rural Electrification Officer, Electricity Commission) expressing his personal opinion, was very pleased that Mr. Matthews had come to the conclusion that 11,000 volts was a good standard to adopt, although there might be instances in which for some isolated cases some other pressure might be economical. Areas in which 6,600 volts had been adopted, but where it was wished that 11,000 volts had been made use of in the first instance, were Northampton and Chester. The County of London Co. had adopted 11,000 volts for its Essex area. The Bedford scheme was a rather special one, and with a view to demonstrating the feasibility of electrifying a large area intensively and quickly, Mr. Phillips, the engineer, had in the first place adopted 6,600 volts, which was the generator voltage, but he had since decided to transform up to 11,000 volts. The reason why 3,300 and 6,600 volts had been adopted in certain cases was that they were the generator pressures; moreover, rural electrification in the past had been carried out sporadically without any regard to a general scheme. Whilst 11,000-volt transformers cost a little more in the smaller sizes, there was not much difference in the larger sizes, and he believed there was very little difference in the cost of switchgear for the higher voltage.

Mr. ROWLAND confirmed the suggestion that there was little difference in the cost of 11,000-volt switchgear as compared with 6,600-volt gear. The increased cost of the higher voltage would, to a large extent, be due to the insulators, but in the case of expensive components (such as switchgear) the extra cost of insulators was not an important item.

Mr. NAPIER PRENTICE, who also supported the standardisation of 11,000 volts, said he had put up some 3,000-volt work years ago, and soon wished it had been for 11,000 volts. The

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reason why he adopted 3,000 volts was that it was the generator voltage of the nearest large town; extensions of the work were carried out at 11,000 volts.

Mr. G. W. MOLLE said his experience in South Lincolnshire also supported the standardisation of 11,000 volts. In order to get over the difficulty of the losses of the early years in that scheme, he had the transformers arranged for 6,600-volt tapping, but subsequently the voltage would be increased to 11,000 V. The reports of the National Electric Light Association of America on the use of various pressures seemed to show that the higher the voltage the fewer the number of accidents. In India where he had 3,300-volt and also 11,000-volt lines, there were comparatively few interruptions of the higher voltage installations, but considerable trouble was caused on the 3,300-volt lines by crows. In the case of bulk supplies, the generating authorities insisted upon oil switches being put on rural transformers, which experience showed to be quite unnecessary. They were afraid that the rural lines would cause trouble in the urban areas, but as a matter of fact all the trouble that did occur actually originated in the urban area. Thus oil switches could be omitted. The cost of switchgear could be reduced if they had not to apply such high test pressures after erection; moreover, applying a high test pressure to material as soon as it was completed weakened the insulation and laid up the possibility of future trouble.

Mr. LEACH said that although it might be true that in some cases 6,600-volt switchgear cost the same as 11,000-volt gear, that fact did not apply universally, because some firms definitely made 11,000-volt, 6,000-volt, and 3,000-volt switchgear. Up to three or four years ago there was quite a fair number of inquiries for 6,000-volt line equipment, but the majority was now for 11,000-volt gear. There were also on the market well-tried designs of air-break switchgear, which was a quite reasonably economical proposition, although he could visualise places where oil switches might be an advantage. Moreover, many oil switches were stood on the ground, so that a fault was not possible between the transformer and the oil switch; that arrangement had many advantages and was not expensive for 3,000 and 11,000 volts. Oil switches could be fitted with some form of time lag that took care of the kicks, so that small surges for short periods would not trip the switches.

Mr. R. BORLASE MATTHEWS said there had been such unanimity of opinion in favour of 11,000 volts that there was very little to reply to. The whole object of the paper was to advocate as high a voltage as possible that could be handled by as cheap apparatus as possible. Only by the use of the air-break switch in some form or other could the isolated consumer or villages between larger towns be dealt with. The whole difficulty was to keep down capital cost; it was a serious difficulty in this country and would have to be met. It was partly countered by the advantages of 11,000 volts. Wider spacing would solve the bird problem.

The Public Works Exhibition.

A Brief Review of Some of the Congress Papers and Exhibits of Electrical Interest.

THE biennial Public Works, Roads, and Transport Exhibition and Congress is promoted in the interest of local government, the display being selected to portray the latest developments in the engineering and other trades that cater for the needs of county, urban, and municipal authorities.

This year's show was the fifth of the series and was housed as usual at the Royal Agricultural Hall, Islington, London (November 18th to 23rd). The Congress Committee included representatives of the Municipal Tramways and Transport Association and of the Incorporated Municipal Electrical Association. The papers presented included those briefly reviewed below:—

Electricity and Roads (*Summary*).

By W. J. JONES, M.Sc., A.M.I.E.E. (E.L.M.A.)

Street lighting, particularly in so far as it contributes to the improvement of public safety and convenience, is a public service which touches every phase of our activities. Good street lighting is automatically associated with well conducted local government, and one cannot help regretting the many opportunities that are lost, since insufficient attention is given to the lighting of important areas. On the Continent and in the United States many bridges are lighted in a manner which enriches the design and accords with their importance. Why not luminous parapets and turrets?

At the last meeting of this Congress it was proposed that a Public Lighting Department should be set up for London to ensure the more economic operation of street lighting in the metropolis, the department to be under the control of an *ad hoc* committee. It was suggested as an urgent necessity on account of the numerous anomalies which existed under the present arrangements, which are in the hands of some 35 different bodies. Unfortunately, the parochial outlook still persists, the number of anomalies multiply, and the general patchiness of the street lighting in London which results continues. The lighting in the neighbourhood of terminal railway stations is as bad as ever; it is just nobody's job to be interested in the subject. Since this Congress last met, the city of Berlin, Germany, which was similarly divided into compartments, has effected co-ordination and already marked improvement is noticeable in the character and quality of its street lighting.

Another important phase that necessitates co-ordination is the lighting of arterial and by-pass roads. The utility of modern highways is frequently limited by inadequate lighting. Whose business is it to light new roads? Undoubtedly, so far as county roads are concerned, the County Council should be the lighting authority, while the subject of lighting those main roads should receive at least equal consideration at the hands of the Road Fund as the construction and maintenance of the roads themselves. In addition to city, urban district, and county council responsibilities, there are directions in which some national co-ordinating force would be advantageous. It should in any case be possible for the responsible authorities to refer the question to a Minister of State.

The minimum mounting height of 13 ft. of the British Standard Specification has resulted in many street installations being changed, and the increased mounting height has invariably brought about considerable improvement in the general quality of the lighting. Further improvement has been effected by the replacement of clear lamps with "Pearl" or "Opal" lamps. The "Pearl" inside frosted lamp, contrary to the expectations of many, gives a diffused light without appreciable loss in output; indeed, the efficiency is so high that the British Engineering Standards Committee has recently decided to include "Pearl" lamps, as regards luminous efficiency, life, &c., under the same rigorous specification used for clear lamps, while recent improvements in the manufacture of electric lamps have brought about marked improvements in luminous output.

No less than sixty-six supply undertakings in the country are supplying over 98 million kWh per annum for public lighting, representing over 211,000 public lamps, some 33½ per cent. of the total street lighting in the country. In the main thoroughfares of the larger towns, and even in the side streets, it already becomes possible to drive motor cars without headlamps, and there are not a few streets in the centre of London and provincial cities where vehicles might safely pass without any lamps upon them at all. That is at least one of the aims which should be kept in view for street lighting if "safety for all" is to be achieved.

Those of us who have been able to study traffic control by lighted signals in America and on the Continent have been convinced of its success as a means of making streets safer and speeding up traffic. The Royal Commission on Transport recommends the use of automatic light signals for traffic control and that uniformity throughout the country should be secured by the erection of the signals under the supervision of the Ministry of Transport, which has issued a memorandum laying down recommendations for the installation of signals. Traffic signs require very much more complete co-ordination than is at present provided. In some areas no attempt is made to light signs, while in others they are incorporated as part of the street lighting equipment. This last procedure cannot be too strongly deprecated, since it invariably results in reducing the effectiveness of the street lighting system and seldom performs satisfactory service as a traffic sign. The standardisation of traffic signs received considerable attention at a meeting of representatives of European countries at Geneva, and a code has been prepared which coincides almost completely with the recommendations of the Ministry of Transport. Great Britain took an active part in the preparation of the code, and some progress has since been made in changing signs to conform to this international agreement.

Town Planning.

Mr. B. PRICE DAVIES (city engineer and surveyor, Bangor), in a paper on the arrangement and economics of a town plan,

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laims that, as compared with indiscriminate planning, at east 25 per cent. can be saved in road length. That is a nodest figure and when resolved into money value it indicates that a considerable saving can be made in the amount of cable required for electric light and power and telephone oad and house services.

Miss J. F. ABRAM'S paper deals with the inter-relation of the ublic services and town planning. She points out that the town planning powers of to-day, though not sufficient as hey stand to ensure a thoroughly well-organised use of nodern services, are capable of materially assisting in the ormulation of a pre-conceived inter-related scheme of utilisation, not only of public services, but also of the land.

Generally, supplies of fuel for lighting and power have an influence on development similar to that of water supply, but in a modified degree, and it will largely increase when the wide-spread electricity schemes already in hand have created an extended series of sub-stations which will supply areas at present comparatively remote. Beyond a point it is more practical and economical to found new sources of supply than to extend existing service mains limitlessly. This very fact, if allowed to govern the distribution of undertakings, should create a strong movement towards decentralization and completely detached, though inter-related, communities, expressing the principles that, from the town planning point of view, are agreed to be favourable and ultimately most beneficial to the community.

It is questionable whether the effect of power lines, if properly dealt with, will be more detrimental to the visual effect of the countryside than the telegraph poles and wires many of us have acquired a secret liking for. As there is no option but to accept this method of distribution, if there are to be efficient supplies, all that remains to be done is to secure that the lines shall as far as possible be subservient to the landscape, and it is for local authorities to see that they are in as strong a position as possible with regard to the preservation of amenities.

Efficient street lighting constitutes one of the most important reasons why housing development should not be contiguous with main highways. The needs of road vehicles and residential property are in this respect entirely opposite: on routes through country areas no difficulty arises, the traffic being adequately served by its own head-lights, but in built-up areas where traffic of all kinds is concentrated it is unsound to make use of these, and vehicles are instantly dependent on street lighting. Existing methods of street lighting in town centres are unsuitable in principle and character, mainly from the point of view of swift moving traffic, as the isolated intermittent points of light provided create confused visibility. Possibly the best solution of the problem of providing generous dazzle-free illumination in the streets, at least in the business portions of urban areas, would be to revert to a system of private supply, whereby all buildings fronting on the street must be flood-lighted. This should cause no detriment to individual interests, as the main aim of commercial enterprises to-day is to force attention. Such methods would not apply in residential districts, as the brilliant illumination created would destroy any sense of restfulness essential to appropriate housing areas, but even there some system of more diffused lighting would be an advantage.

This problem rather emphasises the value of the power to zone land for specific purposes, as by no other procedure than town planning is there any complete possibility of properly segregating types of buildings.

The Exhibits.

Horstmann Gear Co., Ltd., a range of "Newbridge" electric time switches for street lighting, including the neat "T"-type and electrically-wound models.

Blackstone & Co., Ltd., oil-engined electric lighting set, with D.P. battery and switchboard.

Ransomes & Rapier, Ltd., petrol-electric mobile crane for material handling; made in four sizes of from one to six tons lifting capacity.

Messrs. Spiros, portable electrically-driven air compressors.

Weston, Shipley & Weston, Ltd., electric tri-pod lamps for safety trench and excavation lighting.

Hub Ironworks Co., Ltd., street refuge and traffic signal lamps, posts, &c.

Allen-Liversidge, Ltd., electric welding equipment.

Reavell & Co., Ltd., electrically-driven air compressors, including a model specially suitable for operating a concrete breaker for tramway track repairs.

Solanite, Ltd., road direction, traffic warning, and public service signs.

Tungstone Accumulator Co., Ltd., storage batteries.

International Combustion, Ltd., a "Hummer" screen, which will operate wet or dry and requires no lubrication; it is said to be used by 20 large English collieries, the intensive vibration of the screen being maintained electro-magnetically.

Carl Zeiss (London), Ltd., electric reflector lamps for street lighting and public building illumination; vehicle head lamps, and traffic direction indicators and "winkers."

Electricars, Ltd., a 2-ton, low-loading, refuse collecting vehicle which is capable of being driven approximately 25 miles per battery charge, the average speed being 12 m.p.h.; a 1-ton chassis for local delivery service was also on view.

Air Pumps, Ltd., garage pumps and air compressors.

Franco-British Electrical Co., Ltd., reflective night signs.

J. Halden & Co., Ltd., drawing office photo printing machine and duplex radial copying frame.

Electrically-operated office equipment was shown by Addressograph, Ltd., and the Hayward Co.

Legal.

An Electrical Dealer Fined.

THE *Daily Telegraph* reports that at the Mansion House on November 21st Harold Leslie Dixon, trading as "Electradix Radios," Upper Thames Street, E.C.4, was fined £5, with £2 2s. costs, for issuing a trade catalogue bearing his business name, but which did not contain his Christian name or initials, contrary to the provisions of the Registration of Business Names Act.

Mr. W. S. BOURNE, representing the Board of Trade, said that the catalogue advertised a "Government disposal sale," which almost made it appear as though a sale by a Government department was referred to.

The defendant, who said that he was a freeman of the City and a member of the Institution of Electrical Engineers, stated that it was a common trade practice for manufacturers to issue catalogues which did not bear their names, so that a retailer need not disclose the source of supply. A circular letter bearing his name accompanied each copy of the catalogue. He undertook to gum a slip bearing his name to each circular issued in future.

Valve-holder Patent Dispute.

JUDGMENT was given in the Chancery Division last week in the action in which the Benjamin Electric, Ltd., and the Igranic Electric Co., Ltd., sought an injunction to restrain Messrs. Garnett, Whiteley & Co., Ltd., Liverpool, from infringing the plaintiffs' patents for improvements in thermionic valve holders.

Mr. JUSTICE CLAUSON said the action concerned two patents belonging to the plaintiffs—the Benjamin and the Burndept—and they related to holders, the object of which was to minimise the effect of shock or vibration upon thermionic valves. It was obvious that they had been infringed and the questions for the Court were whether prior publication and prior user amounted to anticipation and whether the plaintiffs' inventions contained subject matter for a patent. In both cases the valve holders were carried on springs, the springs serving to carry the holder and to conduct the current to the valve.

Describing the various alleged anticipating inventions and prior user, his Lordship said there was some evidence that in December, 1923, the Sterling Co. made and published a form of holder, but it was not a true anticipation. It was said that the plaintiffs' device was merely a combination of several old features, but it appeared to him that the combination was a new and useful article. He held that both the patents were valid and had been infringed, and therefore there would be judgment for the plaintiffs.

A stay of execution was granted with a view to an appeal.

Stocker v. G. Thomas (Dover), Ltd.

IN the High Court, on November 19th, an action was brought against Messrs. George Thomas (Dover), Ltd., Dover, by Messrs. A. H. & H. G. Stocker, proprietors of Kearsney Court, nr. Dover. The plaintiffs alleged that in 1927 they employed the defendants to overhaul the electric lighting installation for which they paid £156, but afterwards found that the work had been done so badly that they had to have it re-done. They accordingly claimed £151.

The defendants denied negligence, and pleaded that the work was done under the personal supervision of the plaintiffs' foreman of works and approved by him.

Mr. CARTHEW, for the plaintiffs, detailed some of the defects complained of, and said that the joints in the cables were made simply by twisting the wires and re-insulating them, but without soldering. The cables were cramped and tightly pressed together without sufficient insulation. The extensions were contrary to regulations, and wires had been passed down through ceilings without any protection. The defendants did not do the work themselves but sub-contracted with a Mr. Mason, of Dover. It was not true that Brown, the plaintiffs' foreman of works, gave approval of the work as he was not authorised to do so. It was after complaints had been made by the Dover electrical engineer that the plaintiffs employed an expert to examine the work and then found that it had been badly done.

Mr. BROWN, giving evidence, admitted in cross examination, that he might have told the defendants that he was very pleased with the work.

Mr. JAMES DOUGLAS ALLEN said that the work was exceptionally bad and material used was unsuitable for the purpose. Mr. CLERY, of Messrs. Drake & Gorham, who inspected the work done by the defendants, said the re-wiring should have been

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done on the looping-in system. The work as done by his firm would cost £345. Mr. David Connors, foreman to Messrs. Drake & Gorham, said that the junctions in the wiring were done by defendants in a way that no conscientious workmen would ever do them. A good deal of the work was left in a dangerous condition.

Mr. Craig Henderson, for the defendants, said that they agreed that the job ought to have been done on the looping-in system, but they were compelled to do it on exactly the same system as they found it, as time did not permit of adopting any other. They did exactly what they were employed to do and were not allowed to adopt the looping-in system. The joints were done exactly as the old ones had been done. It was impossible in repairing an old system to work in accordance with modern regulations, and it was significant that nothing ever went wrong with the work.

Mr. E. W. Hansell, K.C., Official Referee, giving judgment, said that though it might have been better to adopt the looping-in system and to solder instead of adopting the tie joint, there was no obligation on the defendants under the contract to change the system which they found existing, especially as no danger resulted. The plaintiffs had failed to prove that what the defendants did was not enough to make the work sufficient and safe, and therefore there would be judgment for defendants with costs.

Oxford Corporation v. Oxford Electric Co., Ltd.

On the application of Mr. Tyldesley Jones, K.C., on behalf of the plaintiffs, Mr. Justice Bennett, in the Chancery Division, on November 22nd, fixed December 11th, subject to anything part heard, for the hearing of this action. Counsel said that the action related to the construction of an Act of Parliament under which the Corporation had served notice on the company requiring it to sell to the Corporation the electricity undertaking. Evidence would probably not be called on the claim, but there would be some on a counter-claim.

Compensation Claim Follows Fatal Shock.

Judgement was given by his Honour Judge Beazley in the Hull County Court on November 18th, in the case reported in our last issue in which Thomas Drust, Hessle, claimed £150 from Messrs Watshams, Ltd., as compensation for the death of his son, Sidney Drust, as the result of an electric shock while in the defendants' employment.

His Honour adopted the defendants' view that the deceased had exceeded his duties and had no right to climb a pole at all. Thus he was bound to find that the accident did not arise out of, or in the course of, Drust's employment and the application would be dismissed with costs.

Supply Company's Action Fails.

In the Edinburgh Sheriff Court recently the Lothians Electric Power Co. sued Major A. S. Steven, Longniddry, for £13 18s. 6d. alleged to be due for electricity supplied.

The evidence showed that owing to the defendant's house being frequently closed during his absence, the company had been unable to read the meter for several quarters. Nevertheless, it had sent in quarterly accounts, based on the minimum charge, which had been paid. These amounted in all to £4 12s. 6d. The amount now claimed represented the cost of energy supplied during the whole of that period. Defendant maintained that he was being charged twice over, and offered to pay the difference, £9 3s.

Sheriff Orr said that the defendant had established his case. The company was not entitled to more than £9 3s. and as Major Steven had offered that amount the claim must be dismissed and the defendant's expenses paid.

False Pretences Charge.

At Darwen, on November 23rd, Robert Grimshaw, Blackburn, was charged with obtaining electrical goods by false pretences from Moses Hunt & Son, electricians, Duckworth Street, Darwen. It was alleged that Grimshaw went to the shop and obtained a number of electric lamps, saying that he was doing a job at a shop in Railway Road, which had to be completed by Friday. He failed to pay the account by the day he promised to do so.

Grimshaw, pleading not guilty, asked for an opportunity to obtain legal aid. A remand was granted.

Electrical Trades Benevolent Institution.

The annual festival dinner of the Electrical Trades Benevolent Institution was held at the Savoy Hotel on Tuesday last, under the festival presidency of Mr. Howard Marryat, M.I.E.E., M.I.Mech.E. The dinner was this year followed by a dance, the whole function proving as enjoyable as it was efficient for its benevolent purpose. We propose returning to the subject at great length next week, but meanwhile we may state that donations during the year (including Tuesday's collection) amounted to the record figure of over £9,000.

Correspondence.

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession.

Two-Part Tariff Prepayment Meters.

Replying to Mr. H. Horwood in your issue of November 22nd we would say that every meter engineer "worth his salt" is fully aware that the object of any special tariff is to increase the amount of electricity sold, and also the net revenue of the undertaking.

It can be readily appreciated that a consumption of 1 kWh in 4½ days would hardly be considered satisfactory, and any engineer who was satisfied to consider it so would deserve to whistle for the balance of the fixed charge due.

Taking as our example the same rate as mentioned by Mr. Horwood, we would consider that when only one 1 kW radiator is included in the installation, a daily consumption of 4 units would be fair average; this would clear the fixed charge of 15s. in 30 days, and thus leave the remaining two months clear on the 1½d. rate, and so encourage a more extensive use of their valuable servant, electricity.

Discerning engineers will see, therefore, that the use of this meter, which enables the consumer to obtain current supply on the insertion of the first coin, and does not necessitate the finding of a lump sum before he can commence consuming current, not only solves the problem of popular current supply to consumers of small means and weekly budget, but also constitutes an indicator of the efficacy of their publicity and showroom methods. Collectors' records could be scanned, and wherever the fixed charge is not cleared the consumer should be educated to the more extensive use of current or, if this is not possible, be placed upon a plain prepayment flat rate.

On occasion, the fixed charge may not be quite cleared during a summer quarter. This can be easily adjusted by adding the balance when settling the fixed charge amount to be collected in the subsequent quarter.

Certain go-ahead supply authorities have got over this possible difficulty by doubling the fixed-charge payment for the two winter quarters, and not making any fixed charge for the summer quarters. This has the double effect of ensuring the clearing of the fixed charge during the heavy consumption period, and by its psychological effect increases summer-time consumption, for the consumers do not watch their current consumption so closely when they are getting it all at the lowest rate.

In cases in which the engineer does not consider the 50/50 ration of collection suitable, the meter can be supplied with a ratio of 75/25, thus crediting fixed charge with three-quarters of each coin inserted, and other reasonable ratios can also be supplied.

Possible difficulties which might arise have been thoroughly gone into by many eminent station engineers who have applied the tariff, and the general consensus of opinion has been that "Rex" fixed charge prepayment meter is just the piece of apparatus for the job, and does all that is claimed for it.

Thompson & Co.

London, E.C.3, *November 25th*, 1929.

I am interested in Mr. H. Horwood's letter in your issue of November 22nd and agree with him that the "Rex" meter idea, while very good at first sight, has the serious defect that the worst type of consumer can get a limited amount of electricity at only twice the low unit rate. I am afraid Mr. Horwood has not realised that one type of A.E.G. meter is not really suitable, because the consumer of the type which uses a slot meter will jib at putting in 15s. at once just after the collector has called, and the collector will often find nothing in the meter, not even the meter rent, but he will find an oil lamp in use. The other type of A.E.G. meter is theoretically perfect, but requires a clock or its equivalent, and for that reason is open to objection on the grounds of cost or unreliability and/or inaccuracy, also of illegality under the British Electricity Acts.

W. Fennell.

Northwich, *November 23rd*, 1929.

Rationalisation and Labour.

I was interested in reading in your issue of the 15th inst. the letter from your correspondent "Anti-Rationalisation." He expresses some interest as to the fate of the staffs of the different companies which might be brought together to form the contemplated monopolies. I think he need not be in any doubt as to what would happen to any labour—whether practical or staff—which would be dispensed with. I should think its retention would be a "dubious advantage." What ground is there for suggesting that the withdrawal of these few is ever likely to lead to our re-capturing our position in the world's trade? I have read that monopolists here have entered into agreements with foreign monopolists, and, if "German and American industries with their many trusts and combines tend to the exclusion of foreign imports," what is the reason of

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combining with them? If these trusts and combines enable them to exclude foreign imports what have they to gain by making any arrangements with our people? Are they to share other markets and on what consideration? How would the creation of an international monopoly help our workpeople?

I do not wish to give a bad advertisement to our big industrial companies, but I think it would be interesting to know the amount of capital lost by small firms "who have found it increasingly difficult to carry on" since the date when we lost our position in the world's trade (whenever that was), and the amount of capital lost by the big companies. The shareholders in some of these latter are certainly not smiling at their fate. This brings me to your correspondent's remarks on the railways. I do not know a sufficient number of the staffs rendered redundant by the amalgamations (round which so much nonsense about efficiency and economy was written at the time) to ascertain what has been the result generally to them, but I do know, as a shareholder in several companies, that I am worse off than I was before the amalgamations. I am thankful to the road passenger services for waking up the directors of the railway companies to a sense of their position and for any future advantage which may result therefrom.

Your correspondent seems to think that the standard of living of the workpeople in other countries is lower than that of the workers here, but this I think is open to question. The Archbishop of Canterbury, preaching last Sunday, said he had just heard of a house with sixteen rooms containing seventy-two persons—more than four living in each room. This appears to me to want a lot of beating, I certainly think the directors of the big industrial firms abroad have a lower standard of living than ours, and possibly if some of ours had their remuneration cut down it would help the concerns with which they are connected, and without bringing the gentlemen anywhere near starvation. Of course, if one were to suggest this at a shareholders' meeting, the spokesman of the directors, with difficulty making himself audible through his tears, would point out that he was really paid very little for his services. and there would be shareholders (some of whom would be glad to have the annual fees received by the director from only one of his companies) who would cheer that announcement, which would prove again how correct was the judgment of the Chelsea sage on the inhabitants of this planet.

I think Mr. Parsons is quite right in thinking that the worker will probably think along political lines: it seems to me that he has already done so, and the work of the present Government will make him think harder than ever. Even the staff worker dispensed with by "Rationalisation" or "Monopoly"—whatever it may be called—need not despair. The Labour Government might put him down for a pension if he adopted the slogan "no suspension without pension."

I agree with your correspondent that "Rationalisation" can have only one result—that of increasing prices—and in consequence of reducing the purchasing power of wages.

Anti-too.

November 19th, 1929.

Standardisation of Size of Advertisement Pages.

The variety of page sizes in British trade and technical journals is the cause of much waste of money by advertising through the multiplication of designs and blocks. An advertiser using the same advertisement in three journals having page sizes of, say, (1) 8in. by 5½ in., (2) 9 in. by 6¼ in., and (3) 11 in. by 7½ in., must necessarily have three sets of blocks, and in the case of journal No. (3), whose page differs in proportions from those of Nos. (1) and (2), he must also have a new layout. It might be thought that the unnecessary expenditure under this heading is small, but in actual fact it is a serious item for all advertisers, and in the case of one engineering firm in the North of England is estimated to represent no less than 15 per cent. of the money spent on designs and blocks.

As in the design and production of commodities, so also in the design and production of advertisements, it is essential to eliminate waste and make for greater efficiency and economy by the adoption of standards. The Engineering Section of the Incorporated Society of British Advertisers, Ltd., has therefore initiated a movement towards the standardisation of page size in British trade and technical journals, and this letter sets forth the proposals, so that the opinions of other advertisers than those who are members of the Society may be obtained.

Since any money which is wasted by the advertiser on unnecessary designs and blocks cannot be spent on the purchase of advertising space, such money is lost to the publisher, and it is quite as much to his interest as to that of the advertiser to assist in preventing this waste. The Incorporated Society of British Advertisers, Ltd., has therefore invited the co-operation of the publishers in considering the problem and the practical steps to be taken in adopting standards. The Society desires to thank a large number of publishers for their practical assistance in the formation of a Joint Committee representing the Incorporated Society of British Advertisers, Ltd., the Periodical, Trade Press and Weekly Newspaper Proprietors' Association, Ltd., and independent publishers. This committee now proposes the following:—

"That a standard type space size of 10 in. by 7 in. be adopted for advertisement pages by trade and technical journals in Great Britain, and that if a larger or smaller page be considered to be absolutely necessary this should be in the same ratio—and either 11½ in. by 8 in. or 9 in. by 6¼ in."

The proposals affect only the area occupied by the advertisement, and do not affect the gross page size.

The standards have been proposed for the following reasons:—

(1) 10 in. by 7 in. is already the printed page size of a large number of British trade and technical journals, and has been adopted as standard in Canada and the United States. It further approximates so closely to the page size of many other British trade and technical journals that the change to the standard can be made without undue inconvenience on the part of the publisher.

(2) While it is desirable to have one standard only, this is not practicable at present, and it is therefore proposed that two other sizes should be considered. These, however, are in the same proportion as the 10 in. by 7 in. page, so that the same drawings and designs may be used without alteration.

Although publisher and advertiser will both share the ultimate benefit of standardisation, we realise that the change from over 135 page sizes to 3 for British trade and technical journals will involve a certain amount of expense for the publishers of those journals whose pages do not at present correspond with the standards proposed. It is only reasonable, therefore, that we, as advertisers, should recognise this fact and should be prepared to meet the convenience of publishers in making the change. We propose, therefore, that any change of size should be made at a time convenient to the publisher of any journal concerned, preferably at the end of a volume, and we also propose that when the page size of a journal is slightly reduced, no demand is to be made for a reduction in rate, although the advertiser will lose a small percentage of space.

Many publishers are keenly interested in the proposed standardisation, and are anxious to put our proposals into effect. Before they take such an important step, however, they wish to ascertain the views of their advertisers as a whole. This is a reasonable standpoint to adopt and we invite you therefore to write, giving your opinions on the proposals regarding standardisation made by the Joint Committee, to the Secretary, Incorporated Society of British Advertisers, Ltd., Aldwych House, Aldwych, W.C.2, with a copy of the letter to the Editors of this journal.

Thomas Bell,
Chairman, I.S.B.A.

J. Taffs,
Chairman, Engineering Section, I.S.B.A.

A. W. Swan,
Hon. Secretary, Engineering Section I.S.B.A.

Alfred H. Angus,
General Secretary, I.S.B.A.

Aldwych House, Aldwych, W.C.2, *November 22nd*, 1929.

[We invite advertisers and readers to communicate their views with reference to this appeal.—Eds. Elec. Rev.]

The Point Five Domestic Rate.

The resolution of the Point Fives on July 13th, 1912, was not original, as I obtained the permission of the Ayr Electricity Committee to use my two-part tariff, based on the costs analysis of (*a*) fuel and (*b*) all other charges, in 1895. It clashed with the maximum-demand system, which the consulting engineer, the late Mr. Robert Hammond, preferred, and after much strong protest on my part was distorted into a discount system, which entirely destroyed the beauty and accuracy of the original. The last paragraph of the article is scarcely fair to those who adopt this tariff. The advantages of it are so obvious that I cannot think any supply engineer would adopt it without fairly realising what those advantages are. It certainly gives the greatest possible incentive to long-hour use because, the overhead charges being fully paid in proportion to the size of the connection, the whole of the usage is at fuel cost. In the original it was proposed to adjust the (*b*) charge quarterly, as the connections increased, and the fuel charge in accordance with the variations in price of coal. A common use of it would very soon reveal the most appropriate method of adjustment. My object in writing is to claim the credit due to me as the originator.

Ernest G. Pink.

Blackheath, S.E.3, *November 20th*, 1929.

Specially Designed Cooking Utensils.

The remarkable progress and efficiency that has been made in the construction of electric cookers is entirely due to the advent of the new totally enclosed boiling plates. These are not only damage proof and last much longer than the older visible elements, but, due to their enclosure, foods boiling over in no way affect the element. Why then, with these important improvements, is it that there are so many complaints that

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cooking by electricity is much more expensive than gas? It is entirely due to the apathy on the part of both cooker manufacturers and engineers to examine the cause properly. The failures of boiling plates on the Continent is only 1 per cent., while in England it varies between 15 per cent. and 20 per cent., and, as the manufacturers of plates guarantee their articles from one to two years, the question is of great concern, both to the public and the guarantors. Engineers take no trouble to find the proper type of cooking utensil that should be used; they are afraid to speak the truth to clients and to point out that as the heat is derived by contact and the new boiling plates are machined flat, so must all cooking utensils also be machined flat. We are indebted to Mr. De Brunner of the "Margo" Company for much valuable material on the subject; he has spent considerable time in making tests, and these have been confirmed by the Revo Electric Co., Ltd., and many of the leading engineers, revealing the fact that light-weight spun cooking utensils quickly buckle and warp, increasing the current consumption considerably (see ELEC. REV., November 22nd, 1929, p. 897).

If electrical engineers continue to neglect this subject they will simply play into the hands of their competitors, the gas industry. It is extraordinary what a great amount of prejudice and difficulty we have to overcome in order to get engineers to examine our models and test the claims we make, and before we can establish the most simple principles. Such matters as condensation between the kettle bottom and plate are waved aside as of no importance, whereas they adversely effect efficiency. Sigg's electric utensils are so constructed that condensation is efficiently provided for so that these losses are controllled. On the Continent element kettles are practically unknown, mainly because of the costly maintenance departments that are necessary for their up-keep, none of which are necessary with gas stoves. The writer maintains that most electrical engineers' calculations are entirely upset by these costs, and many of our engineers already predict that as a kitchen utensil the element kettle is doomed. The writer is confident that the electric cooker is the most hygienic method in these days, where labour saving devices are in so much need. It is cleaner, more easily handled by housewives, and easier to understand, but it must be competitive against its older rival gas, and this can only be obtained provided the points raised are properly examined and the public correctly instructed.

S. Davis Nicholls, *Manager*, SIGG, LIMITED.

London, *November 18th*, 1929.

Power Consumers and Peak Loads.

You have recently published very frequent articles and letters in your "Correspondence" columns on the importance of load factor, and all of those publications have aimed at adapting the electricity supply of the country to the existing conditions, whereas it seems to me that it might be well worth approaching the matter from another point of view and adapting the conditions to electricity supply.

The peak loads which generating stations experience only occur during a brief period of the year and last only for a very short time, probably less than an hour. If power users could be persuaded, or even coerced by legislation, to shut down at 4 p.m. instead of at 5 p.m. from the middle of November to the end of December, I consider it would result in a saving of from 10 to 20 per cent. of the cost of generating electricity, and this saving could be handed on to the customer in the shape of lower prices.

The country accepted the Daylight Saving Bill because it was obviously for the greatest good of the greatest number, and I have no doubt that the suggested arrangement would be adopted after a time in a similar way. I do not refer, of course, to power in places of continuous manufacture, but to the consumers who at present shut down at 5 o'clock, after they have created a peak load at 4.45 p.m. by over-lapping the shop lighting load.

I should be interested to see through the medium of your columns the comments of your readers.

H. Wilson.

Ashford, Kent, *November 19th*, 1929.

Small Hydro-Electric Schemes.

With reference to the letter of "Interested" in the ELECTRICAL REVIEW of November 15th, I regret it has not been replied to before, but I have been away on some work in the south.

The following information may be of interest to your correspondent. First of all, an annual load factor of 20 per cent. for many hydro-electric plants is very low, and if you have the water, as one often has, you can load your plant practically up to full load day and night by using all spare energy for heating or cooking, including hot water systems, &c.

In the case under question the capital cost of the sets was high, due to the low fall available (about 4 ft.) and the relatively high cost of the foundation work, which was hindered a good deal by heavy floods. No battery is used with the sets, and a very satisfactory load factor is obtained by utilising current at night for water heating, and for radiators and refrigeration. The sets are able to run practically continuously at large gate openings because of the abundance and reliability of the water in the river, while floods, though fairly frequent during the winter, do not interfere with output by causing more than 20 per cent. reduction as a maximum for short periods only. With regard to the operating cost of the gas engine plant, this was not, of course, new.

M. I. Williams-Ellis.

North Wales, *November 16th*, 1929.

The All-Electric Home.

There is room for a little analysis with regard to Mr. F. J. Moffett's letter, so that we may find out the physiological reason for his expression of preference for a "gas coke" house.

In the first place, he admits its cost was £25 in 1928, and £20 already in 1929, with the worst part to come, against Professor Parker Smith's £43, in a house and with a family which may be larger than Mr. Moffett's. The difference of £18 per annum, or 7s. 6d. per week, would not in itself weigh very much with a man in his position, especially as his family is thereby condemned to the nasty grating job of shovelling coke; and he had to buy and probably has the burden of looking after that "small gas engine" and the poor overworked little generator. It is clear that he is really a lover of electricity—or he would use gas for lighting—or perhaps Mrs. Moffett, "whose opinion on this point is the only one which matters," drew the line just before she reached the item of gas lighting. No, he is a "gas and coker" because he has no public supply of electricity available! How do I know? If he had public mains, there would be no small gas engine and little dynamo! Apart from its cost, noise, and inconvenience, the palpably lower overall efficiency—coal to electricity—*via* the gasworks, gas leaks, the small engine, and the little and essentially inefficient dynamo, as compared with the local power station and mains, would sear his soul, and his expressed love of overall efficiency would bring him on the mains. Once on the main, his wife, "whose opinion," &c., would do the rest. He is, therefore, in the dual positions of the fox who said the grapes were sour and of the wolf who tried to persuade the other wolves to cut off their inefficient tails! Circumstances were against them, and they were very human. They and he have made the best of a bad job, and pretend they are better off without what they cannot have.

Sherlock Holmes.

November 23rd, 1929.

"So Near . . ."

The article in the ELECTRICAL REVIEW of November 8th, by "Ric," is very true. The hardest case of all is that in which the father dies before training is complete, for the delusion (it may be) is hugged that if the fees had been supplied, instead of toiled for, the attainment would have been equal to that of men who were level with him when the check came. Some keep on because they enjoy the effort and because they hate to agree with the "I told you so" brigade.

One thing which puzzles the type of man mentioned by "Ric" is that managers do not seem to see below the surface—they accept paper qualifications and do not give the man a trial.

This fault seems general to the British policy of promotion. A few days ago it was pointed out, as an exceptional case, that a Consul had become an Ambassador. To ordinary people these posts seem to belong to the same profession, yet apparently they are two parellel lines which never meet. Must there also be two lines in the electrical industry—day and shift engineers—which never meet?

Seventy-five per cent. of the posts filled in the last three years have been given to men who have been employed in mains departments, and the shift engineer is now completely forgotten; yet considering the physical strain of shift hours, managers should make it a rule that no man over 35 should be on this work. Although power houses are to be closed down under the grid scheme, I know of only one attempt to give shift men an opportunity of acquiring an insight into other work. As some men like shift hours, a register should be prepared, so that men who are qualified for any day time jobs can have them and their places can be taken by shift men.

Certain people are trying to create the impression that there are not men capable of high promotion. This is rubbish; the brains are there, but owing to some fad or fashion of the moment they refuse to look in the right direction.

Looker-on.

November 22nd, 1929.

Smoothing Circuits.

It is required to calculate the inductance and capacity values for smoothing circuits for use with direct or uni-directional currents. Not being able to find suitable formulæ in the text books, I should be glad to know if any of your readers could say what are the constants for this calculation, or whether it is a matter of trial and error.

J. W. Cooper.

London, N.15, *November 20th*, 1929.

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Parliamentary News.

[By Our Special Parliamentary Reporter.]

Electricity in Essex.

On November 13th Colonel HOWARD-BURY asked the Minister of Transport whether he could give any information regarding the progress of the electricity scheme as it affected the county of Essex.

Mr. H. MORRISON said that with regard to the proposed construction by the Central Electricity Board of main transmission lines in Essex, contracts had been let for the lines from Brimsdown to Barking and from Barking to Rayleigh. The Board hoped that those lines would be in service by the winter of 1930/31.

Steel Telegraph Poles.

On November 19th, Mr. J. H. THOMAS, Lord Privy Seal, informed Mr. Fison that he was still considering, in consultation with the Post Office and other authorities, whether it was possible to use steel, steel and concrete, or concrete poles in substitution for wooden telegraph poles.

B.B.C. Expenditure.

On November 19th, Mr. H. B. LEES-SMITH, the Postmaster-General, informed Mr. N. Maclean that the B.B.C.'s total expenditure during 1928, including provision for depreciation, was £879,324 and its total income was £1,002,505, of which sum £871,764 was in respect of wireless licences.

L.N.E.R. Electrification.

On November 20th, Mr. EDE asked the Minister of Transport if he had drawn the attention of the London and North-Eastern Railway Co. to the possibility of electrifying the railway between Newcastle and South Shields; if so, had he received any reply, and what was its nature.

Mr. H. MORRISON said he had recently been in communication with the Railway Company with regard to this matter, and had been informed that the question of the electrification of the section of line concerned had been considered, and that in the company's view there were a number of other schemes for improvements to its system which should be given precedence of it.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1928.

12,245. "System of distant electric control by synchronised distributors." A. Blondel. April 27th, 1927. (269,443.)

13,029. "Television systems." J. Johnston. May 3rd, 1928. (Cognate application, 14,516/28.) (321,194.)

13,213. "Glow-discharge lamps and the like." J. L. Baird and Television, Ltd. May 4th, 1928. (321,196.)

15,912. "Remote-electric control systems." British Thomson-Houston Co., Ltd. May 31st, 1927. (291,384.)

16,330. "Day and night signs." H. H. Berry. March 5th, 1929. (320,979.)

18,493. "Electrical reproduction of gramophone and like sound records." P. D. Tyers. June 26th, 1928. (321,144.)

18,924. "Switchgear for operating systems of electric lighting in railway carriages and other vehicles." King's Patent Agency. Ltd. (W. B. Phillips). June 29th, 1928. (321,147.)

19,093. "Vacuum tube electric devices." M.O. Valve Co., Ltd., and B. S. Gossling. July 2nd, 1928. (321,197.)

19,175. "Thermionic valves and the like." Allgemeine Elektricitäts Ges. July 2nd, 1927. (293,323.)

21,143. "Sound-reproducing apparatus, and particularly talking motion-picture apparatus." W. E. Beatty (Bell Telephone Laboratories, Inc.). July 20th, 1928. (321,148.)

21,618. "Electromechanical apparatus, such as sound reproducers or transmitters, oscillographs, and the like," P. W. Willans. July 25th, 1928. (321,151.)

21,670. "Electrical point and lock detectors for railways." A. V. Tomlinson (McKenzie & Holland (Australia) Proprietary, Ltd.). July 26th, 1928. (321,156.)

21,992. "Metallic boxes or cases such as used for the mounting of electric switches or other electrical accessories." Simplex Conduits, Ltd., and H. F. McLoughlin. July 30th, 1928. (321,165.)

22,221. "Electric protective systems and apparatus for use therewith." D. Ripley. July 31st, 1928. (321,206.)

22,234. "Switch and other cover plates such as used in conjunction with flush-mounted and surface-mounted electrical accessories." J. A. Crabtree and B. G. Harrison. August 1st, 1928. (321,184.)

22,303. "Illuminating devices for operations." W. A. E. Crombie. August 1st, 1928. (321,208.)

22,442. "Ammeter." A.C. Spark Plug Co. August 19th, 1927. (295,714.)

22,458. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., G. A. Burns, and H. S. Deyes. August 2nd, 1928. (321,216.)

22,525. "Mercury-vapour rectifiers." Akt. Ges. Brown, Boveri et Cie. February 23rd, 1928. (306,520.)

22,551. "Light-sensitive apparatus. Westinghouse Brake and Saxby Signal Co., Ltd January 23rd, 1928. (304,644.)

22,552. "Light signals." Westinghouse Brake and Saxby Signal Co., Ltd. November 25th, 1927. (301,056.)

22,564. "Electric discharge devices for use as relays." Siemens-Schuckertwerke Akt Ges. August 17th, 1927. (295,685.)

22,611. "Jointing of multi-core electric cables." W. T. Henley's Telegraph Works Co., Ltd., A. W. C. McArthur, and H. C. Hoban. August 3rd, 1928. (321,223.)

22,646. "Devices for interrupting and for closing electric circuits employed in connection with internal-combustion motors and other electric circuits." P. E. J. Eggers. August 4th, 1928. (321,226.)

22,780. "Electrical maximum-demand indicating device." Siemens-Schuckertwerke Akt. Ges. August 11th, 1927. (295,389.)

22,934. "Thermionic valves." Allgemeine Elektricitäts Ges. August 9th, 1927. (295,330.)

23,211. "Electric protective arrangements." British Thomson-Houston Co., Ltd. August 11th, 1927. (295,402.)

23,298. "Distance or depth-finding systems or apparatus." Submarine Signal Co. April 17th, 1928. (309,901.)

23,521. "Terminal boxes for multi-core cables." International General Electric Co., Inc. August 15th, 1927. (295,640.)

23,633. "Sound-reproducing devices." British Thomson-Houston Co., Ltd., and L. B. Ault. August 16th, 1928. (321,246.)

23,644. "Means for operating wireless sets from supply mains or machine generators." Telefonaktiebolaget L. M. Ericsson. April 17th, 1928. (309,902.)

23,725. "Insulated cable joints." British Thomson-Houston Co., Ltd. August 18th, 1927. (295,724.)

24,711. "Slow-motion mechanism or fine-adjustment device for electrical tuning apparatus." L. E. Fillmore and L. W. Fillmore (trading as Jackson Bros.). August 28th, 1928. (321,259.)

25,144. "Portable electric lampholders." W. R. Millar. September 1st, 1928. (321,264.)

25,214. "Suspension insulators and strain insulators for electic conductors." Compagnie Générale d'Electro-Ceramique. September 3rd, 1927. (296,673.)

25,258. "Connecting devices for use in electric circuits." Callender's Cable and Construction Co., Ltd., and A. E. Wilson. September 3rd, 1928. (321,265.)

25,259. "Connecting devices for use in electric circuits." Callender's Cable and Construction Co, Ltd., and A. E. Wilson. September 3rd, 1928. (Cognate application, 4,628/29.) (321,266.)

25,261. "Fuse boxes for use in electric circuits." Callender's Cable and Construction Co., Ltd., and A. E. Wilson. September 3rd, 1928. (321,267.)

25,484. "Electric lamps." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). September 5th, 1928. (321,271.)

25,727. "Electrostatic acoustic device." Newcombe-Hawley, Inc. March 12th, 1928. (307,734.)

25,728. "Electrostatic sound reproducers." Newcombe-Hawley, Inc. July 11th, 1928. (315,294.)

26,713. "Electric heating and cooking apparatus." I. T. Stokes and A. G. Ionides. September 18th, 1928. (321,278.)

26,982. "Apparatus for use in electric arc welding." Quasi-Arc Co., Ltd., and R. J. Musto. September 30th, 1928. (321,279.)

27,113. "Electrical cut-outs." General Electric Co., Ltd. September 30th, 1927. (297,833.)

27,350. "Devices for the automatic control and regulation of temperature in electric heating and cooking apparatus." G. B. M. Kelp and M. H. Jessen. September 24th, 1928. (321,280.)

27,898. "Electric switches." British Thomson-Houston Co., Ltd. September 29th, 1927. (297,846.)

29,004. "Induction motors." British Thomson-Houston Co., Ltd. October 11th, 1927. (298,567.)

29,271. "Heating buildings by electricity." W. C. King. October 11th, 1928. (321,299.)

29,872. "Fire-alarm systems in conjunction with telephone exchange systems." Relay Automatic Telephone Co., Ltd., and T. M. Inman. October 16th, 1928. (321,303.)

31,177. "Automatic electric switches." C. Hall. October 27th, 1928. (321,318.)

32,697. "Electromagnetic vibratory devices for acoustical instruments." Wireless Music, Ltd., and M. Trouton. November 8th, 1928. (321,327.)

33,812. "Electrical conductors." Gramophone Co., Ltd., C. O. Browne, W. F. Tedham. November 17th, 1928. (321,335.)

34,802. "Engine starters." M. P. Whitney. November 26th, 1928. (321,342.)

34,803. "Engine starters." Eclipse Machine Co. April 5th, 1928. (309,117.)

37,701. "Explosion pots for oil switches." International General Electric Co., Inc. December 24th, 1927. (Addition to 300,650.) (303,010.)

1929.

532. "Electric fluid heaters." F. W. Golby (Red Spot Electric Co., Inc.). January 7th, 1929. (321,357.)

1,835. "Electric incandescent lamps." M. Leff. January 18th, 1929. (321,360.)

2,953. "Means for leading-in electric conductors through metal walls." R. Bosch Akt. Ges. February 27th, 1928. (306,894.)

3,407. "Electrically-operated toy railways and the like." A. Schuhmann. February 1st, 1929. (321,368.)

4,616. "Electric melting furnace." Electric Furnace Co., Ltd. February 11th, 1928. (305,952.)

6,074. "Electric cables." C. Cremer. September 20th, 1928. (319,315.)

7,034. "Picture and the like radio-transmission systems." Telefunken Ges. für Drahtlose Telegraphie. March 3rd, 1928. (307,309.)

8,893. "Metallic-vapour lamps." J. C. Pole. March 20th, 1928. (308,262.)

18,905. "Directional aerials for the transmission and/or reception of electromagnetic waves." W. E. Williams. November 9th, 1928. (Divided application on 317,301.) (321,385.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from November 20th :—

S. S. Siemens-Schuckert (lettering and design). Nos. 487,003, 487,005, 487,006, and 487,007. All goods in Classes 6, 13, 18 and 22; and S. S. Siemens (lettering and design). Nos. 496,828 and 496,829. All goods in Classes 6 and 8.—Siemens-Schuckertwerke Gesellschaft, Siemensstadt, Berlin. (British representaties: Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, W.C.2.).

Epoch. Nos. 506,674 and 506,675. All goods in Classes 6 and 18.—Electrolux, Ltd., 153-155, Regent Street, W.1.

D.P. No. 503,296. Class 8. Electric batteries (not for medical purposes).—D.P Battery Co., Ltd., Bakewell, Derbyshire.

Trichord. No. 505,825. Class 8. Radio-telephonic apparatus and parts thereof, &c.—British Homophone Co., Ltd., 67-69, City Road, E.C.1.

Exwell. No. 506,681. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—Erich Cahn, Aschaffenburg, Germany. (British representatives: Boult, Wade & Tennant, 112, Hatton Garden, E.C.1.).

Phœbus. No. 490,632. Class 13. Electric lamps (ordinary).—British Thomson-Houston Co., Ltd., Crown House, Aldwych, W.C.2.

Semiscure. No. 506,711. Class 13. Electric lamps (ordinary).—Lunar Electrical Co., Ltd., 3-7, New Street Square, E.C.4

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New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ACCRINGTON.—Housing scheme (48), Hollins estate; H. Sanderson, borough engineer, Town Hall.

ACREFAIR.—School, for Denbighshire E.C.; W. D. Wiles, county architect, Wrexham (returnable deposit of £3 3s.).

ALTRINCHAM.—Town hall extensions (£8,000), for the U.D.C.; surveyor.

BARTON-ON-HUMBER.—Secondary school, for Lindsey E.C.; H. G. Gamble, county architect, Bank Street Chambers, Lincoln (returnable deposit of £3 3s.).

BATH.—Reconstruction of business stores, Bath Street, for McIlroy, Ltd.

BEDFORD.—Additional 130 houses, for the T.C.; borough surveyor.

BIRCOTES.—Cinema; J. H. Metcalfe, builder, Doncaster.

BLACKPOOL.—Station at Squires Gates and South Shore, for the L.M.S. Railway Co.

BOGNOR REGIS.—School, for West Sussex E.C.; director of education, Chichester.

BOLTON.—Extensions, tram repair depôt, Carlton Street; borough engineer. Stores, Hall estate; Bolton Co-operative Society, Ltd.

BUCKLOW.—Alterations and additions to sewage disposal works, Dunham Massey; R. C. Cordon, engineer and surveyor, 24-26, Station Buildings, Altrincham.

CARMARTHEN.—Cinema, for the Capitol (Carmarthen) Cinema, Ltd.; J. A. Lawrence, architect and surveyor, 1, Castle Street, Cardiff (deposit £2 2s.).

CAPE TOWN.—Air port (£60,000); Government and Corporation.

CHEADLE AND GATLEY.—Extensions, Council offices, for the U.D.C.; J. Holt, architect, 49, Deansgate, Manchester (returnable deposit of £1 1s.).

CHEADLE (STAFFS.).—Houses (100), Brookhouses, for the Berry Hill Collieries, Ltd.

CHESTERFIELD.—William Rhodes School, Boythorpe (438 places); Dr. H. G. Stead, chief education officer.

CHINGFORD.—Additional 40 houses, for the U.D.C.; surveyor.

COLCHESTER.—Offices, &c. (£10,000), for the T.C.; borough surveyor.

COVENTRY.—Housing scheme (286), for the T.C.; A. F. Underhill, housing director (returnable deposit of £5 5s.).

DAGENHAM.—Secondary school, Parsloes Avenue; Essex E.C.

DONCASTER.—Sewage disposal works, Braithwell; surveyor to R.D.C. Model dairy, warehouse, and packing factory, York Road, for the Co-operative Society; E. G. Brown, secretary.

EDINBURGH.—Additions to premises and plant (£30,000), for Bruce Peebles & Co., Ltd.

ESTON.—Secondary school; North Riding E.C.

ETON.—Rebuilding premises, for Eton College; Mr. Fisher, architect.

FAVERSHAM.—Houses (68), London Road site, for T.C.; borough surveyor.

FIFESHIRE.—Additions to Bell-Baxter School, with electric lighting (£30,000); G. Sandilands, architect, Fife Education Authority, Kirkcaldy.

GLASGOW.—Houses (280) at Haghill, for Corporation; architect, Housing Department. Machine shop, for Wilson Bros. Pipe Fittings, Ltd., 100, Fordneuk Street; the manager.

GOLBORNE.—Additional 52 houses, for the U.D.C.; surveyor.

GOSPORT.—School, for the borough E.C.; director of education.

GUILDFORD.—Shops (6), High Street; F. Scott.

HALESOWEN.—Houses (215), for the U.D.C.; E. L. Lewis, builder. Extensions, Grammar School, for the Worcestershire E.C.; A. T. Butler, architect, 31, Priory Street, Dudley.

HALIFAX.—Erection of Girls' High School, Craven Lodge, with electrical work; A. C. Tipple, borough engineer, Crossley Street (deposit £2 2s.).

HAYWARD'S HEATH.—Houses (56), for the U.D.C.; W. Tickner, builder, Worthing.

HORTON.—Ward extension, mental hospital; L.C.C. architect.

IRISH FREE STATE (KERRY).—Conversion of workhouse in Tralee to hospital, for the County Board of Health (£9,278); E. W. Murphy, borough engineer, Dublin.

KIDSGROVE.—Two schools (1,000 places), for Staffs. E.C.; E. Joy, clerk, Stafford.

KILMARNOCK.—Housing scheme (40), for the T.C.; T. C. Stewart, Clydesdale Bank Chambers.

KIRKINTILLOCH.—Extension of Broomhill Home; the medical superintendent.

KIRRIEMUIR.—Housing scheme; burgh surveyor.

LEEDS.—Construction of municipal buildings, The Headrows (£360,000); city engineer.

LINCOLN.—Extensions to engineering department, Technical College (£11,000); W. S. Watkins, architect, St. Edmund's Chambers, Silver Street.

LIVERPOOL.—Stadium; land steward and surveyor, Municipal Buildings, Dale Street.

LONDON (BECONTREE, E.).—Technical and secondary schools, L.C.C. housing estate, for Essex C.C.; director of education, Chelmsford.

(SHOREDITCH, E.).—Reconstruction, Drysdale Street area; dental hospital and health offices, Laburnum Street; borough engineer.

(ST. PANCRAS, N.).—Reconstruction of 357, Euston Road, and 44, Warren Street; M. K. Matthews, architect.

(TOOTING, S.W.).—Cinema, Mitcham, Road; G. Massey, architect. Alterations and additions, 149-155, Mitcham Road; Myall Bros.

(PUTNEY, S.W.).—Reconstruction, Putney Bridge, for the L.C.C.

(FULHAM, S.W.).—Wesleyan school, Munster Park (£7,500); trustees. Premises, adjoining power station (£33,000); Shell-Mex, Ltd. Building at corner of Hammersmith Road and Addison Bridge Place; W. E. Sanders. Buildings, Parsons Green Lane and Beaconsfield Road; S. J. Watson.

MAIDSTONE.—New buildings, for grammar school for girls; Kent E.C.

MILNROW.—Housing scheme (50); A. S. Whipp, surveyor to U.D.C.

MARLBOROUGH.—Extensions, grammar school, for Wilts. E.C.; Mr. Pullinger, director of education, Trowbridge.

NORTHALLERTON.—Post office (£10,000), for H.M. Office of Works, King Charles Street, London, S.W.

NORTHFLEET.—Warehouse and offices; Henley's Tyre and Rubber Co., Ltd.

NOTTINGHAM.—Operating theatre at the General Hospital (£7,000); Evans, Clarke & Wollatt, architects, Eldon Chambers, Wheeler Gate.

OLDHAM.—School (850 places), Limeside, for the borough E.C.; J. J. Williams, clerk.

PAIGNTON.—Alterations and additions, Gerston Hotel; J. S. Huggins.

PAISLEY.—Alterations to garage, for Scottish General Transport Co., Ltd., Kilmarnock; the manager.

PERSHORE.—Central school, for Worcestershire E.C.; director of education, Worcester.

PURFLEET.—Additional 200 houses, for the U.D.C.; surveyor. Works extensions, for Jurgens, Ltd.

RANSON.—Extensions, sanatorium; Notts C.C.

RETFORD.—Two new schools and extensions to Thrumpton school, for the E.C. (£31,800).

ROCHDALE.—Waterworks at Wardle; borough waterworks engineer.

RUGBY.—Improvements, Rugby Hospital (£20,000); superintendent.

ST. HELENS (LANCS.).—Housing scheme, for the Council of Christian Witness; W. B. Fletcher, architect, George Street.

SOUTHEND-ON-SEA.—Factory, Priory Crescent, for E. K. Cole, Ltd.

SPALDING.—Housing scheme (31), for the U.D.C.; A. E. Palmer, architect, 1a, Pinchbeck Street (returnable deposit of £1 1s.).

TREDEGAR.—Station (£12,000), for the L.M.S. Railway Co.

WATFORD.—School (400 places), Leggatt's Way, for Herts. E.C.; C. E. Longmore, clerk, Hertford. Extensions, Children's Homes, for the Board of Guardians; F. Wilson, clerk (returnable deposit of £2).

YEOVIL.—Garage, &c. (£20,000), Clarence Street, for Douglas Seaton, Ltd., London, W.

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The ELECTRICAL REVIEW

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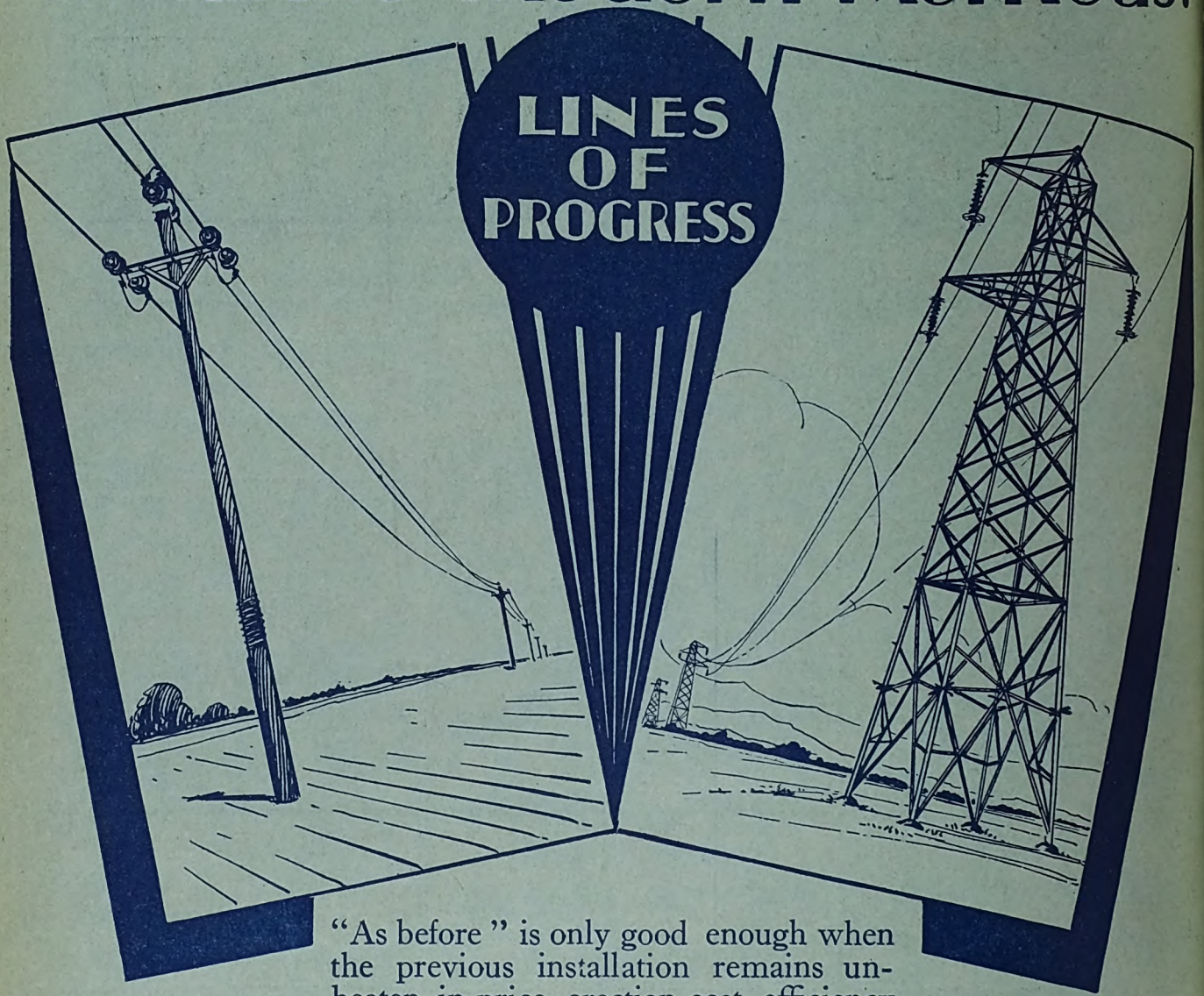

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The

Electrical Review

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For List of Foreign Agents for the ELECTRICAL REVIEW see Advertisement Supplement.

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The Treatment of Flue Gases.

THE two most important events of the week as regards the generation of electricity have been the dismissal of the appeal of the Manchester Corporation from the injunction granted against it by the Court of Appeal in relation to the Barton power station and the publication by the Ministry of Transport of an interim report on the treatment of sulphur fumes in connection with the Battersea power station.

The Corporation has, however, obtained by its appeal the suspension of the injunction for a further period of one year from the date of the latest judgment. This concession is, we think, an important one in the light of the successful experiments carried out at the Grove Road station for the purpose of eliminating sulphur fumes from flue gases. It is true that the acceptance by the Government Committee of the conclusions reached by the London Power Company's advisers is qualified, but caution is understandable in view of the mystery which at present surrounds the most important feature of the experiments, *viz.*, the oxidation of sulphurous to sulphuric acid during the process of hot-water scrubbing—a transformation which removes practically all sulphur fumes from the chimney emissions and ensures that, with the use of no more diluent than is obtainable from the normal quantity of condensing water, the discharge into the river shall be free from acid.

The report of the consultants suggests that with stoker-fired boilers the problem of dust emission is not difficult of solution. If the inclusion of one thing implies the exclusion of another, this statement means that they have not the same belief in the efficacy of methods adopted for dealing with such emissions from pulverised-fuel installations, a conclusion with which many will disagree. For many pulverised-fuel installations it is claimed that all but a negligible amount of the grit can be trapped. In the case of Battersea the sulphur washing plant will dispose of the dust nuisance also.

The report seems to offer very distinct promise of fruitful results when the methods used at Grove Road are applied on a larger scale at

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Battersea, and we see no reason to doubt that they will be equally efficacious in the latter case.

The experiences of the Manchester Corporation and of the London Power Company provide an illustration of the difficulties that accompany the choice of a power station site. Barton is attacked because it is located in open country and destroys vegetation, Battersea because it is to be built in urban surroundings and might still further pollute the air and also injure buildings. We would, in the case of Battersea, have preferred a site several miles to the east of that selected. In addition to the obvious reasons, of which we have heard so much of late, a site further down the River Thames would have borne out the contention often advanced in favour of electricity, that it can be produced where conditions are most favourable for the purpose and transmitted to the point of most advantageous use. It must be conceded, however, that to supply London with electricity presents problems not found elsewhere. London is like no other British town in size of population and congestion of its subsoil, and since a practicable method of transmitting nearly 400,000 kW from outside, as an alternative to the Battersea station, has not been put forward, the scheme of the London Power Company holds the field.

Electrical Trade Benevolence.

THE net result of the recent annual festival of the Electrical Trades Benevolent Institution is extremely gratifying. To Mr. Howard Marryat, the festival president, to whose urgent appeals we gave prominence here several weeks ago, the remembrance of his year of leadership must always be a pleasure, because he secured substantial aid in bringing the pension stage so much nearer. We tender to him the thanks of the industry and our own congratulations. Thanks are also due to those who responded so generously, and to the Executive Committee which has always devoted itself so self-sacrificingly to the investigation of "cases," and to the administration of the Fund's affairs.

In alluding to his retirement from the full-time secretaryship and his acceptance of the honorary secretaryship, in the ELECTRICAL REVIEW for May 25th, 1928, we paid a tribute to Mr. F. B. O. Hawes for the very valued services that he had rendered to the E.T.B.I. over a long period. We also announced that Captain J. T. Keeping had been appointed to carry on the secretarial duties, with the assistance and advice of Mr. Hawes in reserve in his honorary capacity. Mr. Hawes has now definitely retired and at last week's Festival he was presented with tokens of appreciation.

From the report of the dinner, which appears elsewhere in this issue, it will be seen that Captain Keeping has more than justified his appointment by producing excellent results in the collection of donations and subscriptions by his unremitting efforts. We have felt for years past that the best interests of the Fund would be served in this way, and in congratulating the new secretary upon recent achievements, we may assure him that the industry looks to him, both on his own initiative and at the instigation and under the inspiration of the Executive, so to secure everybody's co-operative generosity that before we are all much older the payment of reasonable pensions out of interest on invested capital may be *un fait accompli*.

If we may stress one point in particular at the present stage, we would like to appeal to the leaders of the electrical industry—either personally or through their companies, or both—to find the further sums necessary to raise the funds to the pension-paying figure. Our industry is great, and to have a mere £50,000 invested for those who fall by the way is really the minimum that could be expected from it, for such a sum is small compared with what obtains in some other far less important trades. May we therefore urge that the festival fund be not considered closed, but that even now there may be such a spirit of generosity and duty abroad amongst us that without a lull the secretary may find himself in the position of being able to report to his Executive, a constant inflow of large sums until the goal, at present set, is reached? Approximately £4,000 is needed to complete the £50,000. Why wait? There are less than three weeks to Christmas! The mass of smaller sums has always been a source of strength and must continue to be so, and every donor or subscriber of these sums can feel that all the time he is helping either to keep the wolf from the door, or paying the rent, or finding health and employment, for needy folk, some of whom, perhaps, have worked side by side with him in past days; and, if a number of gentlemen or their companies will find further substantial sums, such as Mr. Marryat has been instrumental in bringing in, they will be able to feel that by making pensions possible, they have lifted the burden of a gnawing anxiety from minds of men and women who are permanently unable to help themselves. Let the recent achievement be an incentive to further immediate giving on a substantial scale, and to an all-round decision from the rank and file to do their utmost to put the finances on that sound basis which we have regarded as the ultimate objective, from the moment when the Fund was launched and we issued through these columns our first appeal on its behalf.

Education for Salesmanship.

As will be seen from the review which appears in this issue, the interim report of the Government Committee upon Education for Salesmanship is devoted to a study of the question of marketing British goods abroad. It appears to be the object of the Committee first to state the nature of the problems which are to be encountered and then (in a final report) to shape a scheme of education which will equip men to meet those conditions. The interim report has not been written for leaders of electrical industry; it seems to have been prepared more for general consumption, to guide our legislators and educational authorities.

As a survey of the general question the report is very interesting, although little more than a recapitulation of matter which has received considerable attention in recent years in our pages and elsewhere. The British exporter is again shown his deficiencies, as compared with his foreign competitors. He is taken to task for his neglect to study the habits, customs, and regulations of the people to whom he wishes to sell his goods, and altogether he is almost beyond salvation if the evidence is to be believed.

It would appear that this evidence was, perhaps, a little one-sided, and that really our salesmanship methods are frequently far from inferior to those of our competitors. We are convinced, and our export figures show, that electrical manufacturers, at least, know a great deal regarding the marketing of their goods overseas.

Two matters which do not come within the Committee's scope, but are mentioned in passing, are prices and credit. While we have no doubt that salesmanship can be considerably improved, we think that these two problems are probably the greatest obstacles which have to be surmounted.

Thus, so far as the electrical industry is concerned, we see no reason for revising opinions which we have long held and which were expressed in an article on "Salesmanship Abroad" in our issue of October 5th, 1928.

From many points of view the second part of the report should be the more important half. The question of training for salesmanship, whether at home or abroad, is one on which experts hold different views. Schools of salesmanship certainly have not always justified their existence and they have come in for a good deal of criticism. Perhaps the report will tell us whether we are right in agreeing with Mr. E. E. Sharp's little remark at a recent E.D.A. conference, or whether Mr. Dale's view is correct. At the moment we are inclined to agree with both.

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Pulverised-Fuel Firing.

As, no doubt, is the case with all new developments, there has been until recently, at any rate in this country, a certain "secrecy" about pulverised-fuel firing, and because of that the full account we are able to give, with comprehensive test data, of the plant which has been erected, tested, and is now running with marked success at the Nechells (Prince's) power station of the Birmingham Corporation in this issue will, we believe, be particularly welcomed. The installation is on the storage system, and it reopens the much-discussed question of the unit *versus* the storage system, especially in the light of the fact that at Nechells' new sister station, Hams Hall, the unit system has been adopted. Apart from the suggestion that the firing system adopted at Hams Hall savours somewhat of experiment, we believe that the two installations at Birmingham point directly to the essential difference between the two firing systems and also to the particular advantages peculiar to each method. Hams Hall will, no doubt, be a base-load station, and the "continuous-flow" principle of the unit system certainly lends itself admirably to meeting constant loads over long periods. On the other hand, the experience obtained at Nechells strongly points to the adaptability of the storage system to widely varying load conditions. We were fortunate to be at Nechells recently during Birmingham's dinner hour, at a time when the demand from one of the boilers dropped from nearly full load to something like one-tenth full load, and we were immensely impressed by the ease of control and the particularly smooth running of the plant. There was, to the "outsider," nothing but the steam-flow meter to indicate the widely varying conditions.

One very interesting feature of the Prince's equipment is Mr. R. A. Chattock's scheme to increase the efficiency by leaving the water tubes in the combustion chamber bare to the chamber interior, and in view of the results obtained and of the anticipated life of five years for the combustion chamber before renewals are necessary, the manifestation of the scheme is a creditable achievement.

Another outstanding point in connection with the installation is the electrostatic precipitating plant erected to arrest the dust from the drying plant in place of cyclones, and it is of great interest to learn that the saving in coal as a result of the plant is such as will quickly cover the capital cost of the installation. A further feature to which attention might profitably be drawn, in that it will help to allay fears of many supply men, is that pulverised fuel has been stored for five months without occurrence of spontaneous combustion.

Finally, to deal with pulverised-fuel firing in its broader sense, that is, pulverised-fuel *versus* stoker firing, it is probably a safe conclusion that for large generating stations the former system has now become definitely established as the superior one, even taking into consideration capital costs. A working efficiency of 85 per cent., taking the gross calorific value of coal, leaves a wide margin to cover various discrepancies.

Electric Bronze Furnaces.

IT would be interesting to have actual figures of electric furnaces in operation in British brass foundries, especially of those that have been installed during the last two or three years. It must be admitted that the electric furnace, as far as iron and brass foundries are concerned, has not made much progress in England. It is rather surprising that the duplexing process, in which the cast iron is super-heated in the electric furnace after being melted in the cupola, has not been more generally adopted, because, for thin high grade castings, better results are obtained but the cost factor has no doubt been a deterrent. In the case of brass foundries the capital expenditure involved in many cases prevents the adoption of electric melting, and it has to be remembered that there are comparatively few large brass foundries in this country, the great majority of them being small shops employing two or three men. American founders have proved the value of electric furnaces, and one Canadian foundry has recently installed a furnace with a capacity of 350 lb. and two with a capacity of 1,000 lb. The owners had previously installed two furnaces, and the important advantages obtained in bronze melting operations made them decide on a more extensive use of electric furnaces.

Our Power Resources.

ONE of the most interesting compilations which resulted from the 1924 World Power Conference was a survey of the world's power resources, the figures of which have only recently been published and form the basis of an article elsewhere in this issue. In this connection it is interesting to note that invitations are now being issued for the second plenary meeting of the World Power Conference, to be held in Berlin, Germany, between June 16th and 25th, 1930. It bids fair to be one of the most important international gatherings of a technical kind that has ever been held, and a unique opportunity for an interchange of ideas on power problems. Amongst the electrical subjects which are suggested for discussion are power distribution, factory lighting, electrical applications in structural and railway engineering, electro-medical work, and radio-telephony broadcasting.

We have heard much in the past of the threatened exhaustion of power resources, but hitherto experience has shown that consumption is more than sufficiently replaced by new discoveries. Of the three main resources, *viz.*, coal, oil, and water, the last named alone does not represent destruction of the world's capital value.

As our contributor points out, the exhaustion of power resources means—to the engineer—the end of the world, and it is therefore of the first importance to him that he should "survey and study."

London Traffic Co-ordination.

WHEN the present Government took office the majority of the House of Commons was against the traffic co-ordination scheme arranged between the London County Council and the "Underground" group. The Bills promoted to give effect to the scheme were consequently rejected, but the problem with which they were designed to deal remains and is accentuated by delay.

In a statement made in the House this week Mr. H. Morrison, Minister of Transport, said that the Government was fully alive to the necessity for a measure of co-ordination which would enable the undertakings concerned to be self-supporting, while providing adequate travelling facilities for the public. It was realised that only efficient commercial management could bring about this desirable state of affairs, but it was intended to retain the principle of public ownership. The Government proposed to consult with all the interests concerned in an endeavour to formulate an acceptable scheme, and the assistance of "an eminent chartered accountant" was to be obtained. The magnitude of the task can be gauged from the fact that the total capital involved is in the neighbourhood of £120,000,000.

It is considered unlikely that the Government will endeavour to establish purely State or municipal ownership. The formation of an authority of the nature of the Central Electricity Board would appear to be the aim.

Red and Buff.

IF exhibitors in the Electrical Section of the British Industries Fair follow the suggestion of the Management (see our "Business Notices" to-day), the usual "Black and White" will give place to buff and red as the distinctive colouring. The lead in this direction has been given by the British Electrical Development Association in the attractive kiosk that it has decided to erect in a central position among the electrical exhibits, and the Electrical Advisory Committee asks that these colours should be adopted generally by electrical concerns. Ambitious E.D.A. adds "gold" to its buff and red; exhibitors will follow suit during the run of the Fair.

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A Pulverised-fuel Installation.

A description, with test data, of boiler equipment, designed and erected by Messrs. Simon-Carves, Ltd., at the Nechells municipal power station, Birmingham.

THE plant about to be described constitutes the extension carried out at the Birmingham Corporation electricity works, Nechells, to the existing boiler plant, some of which was already fired with pulverised fuel. It is significant that this system of firing had proved itself sufficiently attractive over a protracted period to warrant its being employed again for the extensions. The new plant represented a very bold policy on the part of the city electrical engineer, Mr. R. A. Chattock, M.I.E.E.—to whom we are indebted for permission to publish these details—in that it includes the largest boilers at the time to be employed in Europe by any system of firing. This departure, as regards the boiler units, together with other special features embodied in these extensions, constituted a great advance in modern boiler-house practice so far as large units are concerned. Other features of this installation which are of particular interest are the water-cooled walls and roofs of the combustion chambers, and also the electrostatic precipitation of dust from the dryers.

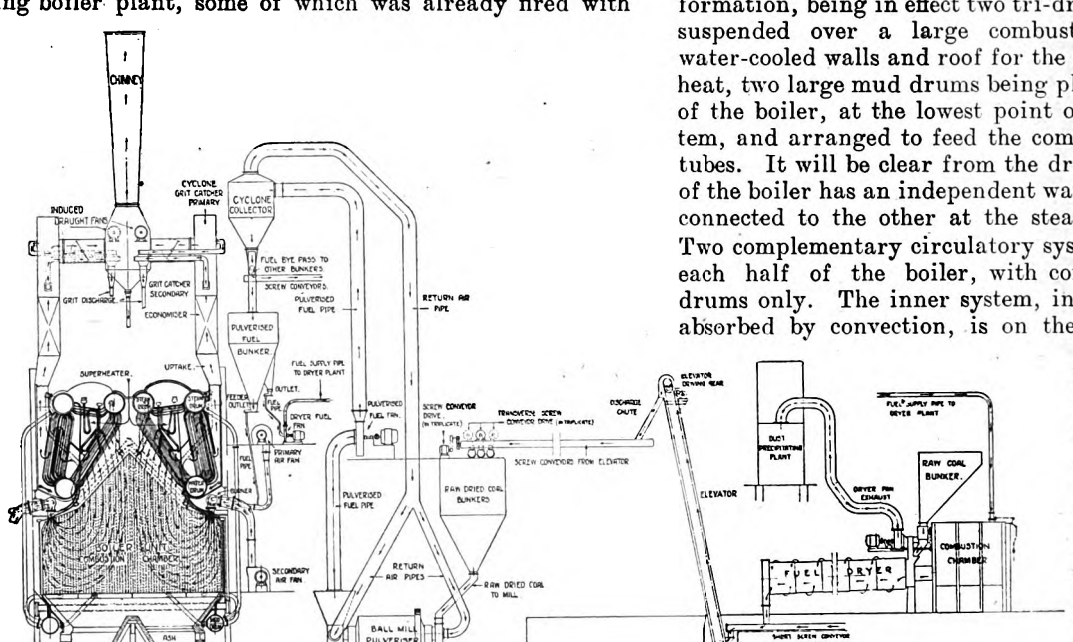

Fig. 1.—Diagrammatic Arrangement of P.F. Plant at Nechells Power Station.

This installation, the diagrammatic arrangement of which is shown in fig. 1, is operated on the "central" system of pulverised-fuel firing, comprising four rotary dryers, four ball mills, and four patent multiple-drum boilers. The boilers, fig 2, are of the steeply-inclined bent-tube type, arranged in what has been called "W" formation, being in effect two tri-drum convection boilers suspended over a large combustion chamber having water-cooled walls and roof for the absorption of radiant heat, two large mud drums being placed one on each side of the boiler, at the lowest point of the circulatory system, and arranged to feed the combustion chamber wall tubes. It will be clear from the drawings that each half of the boiler has an independent water system and is only connected to the other at the steam outlet (see fig. 3). Two complementary circulatory systems are formed in each half of the boiler, with confluence in the steam drums only. The inner system, in which heat is chiefly absorbed by convection, is on the tri-drum principle. Most of the radiant heat from combustion of the fuel is absorbed in the outer system, which embraces the combustion chamber walls and roof. The circulation has proved to be remarkably good at all loads, as is evidenced by the exceptionally steady water level gauges and absence of priming. The excellence of the general design, proportion, and disposition of heating surface is clearly shown by the results attained.

Each of the four boilers was rated originally to evaporate 150,000 to 180,000 lb. of steam per hour at 320 lb. per sq. in. pressure at the superheater inlet, the final temperature of the steam being 740 deg. F. at the

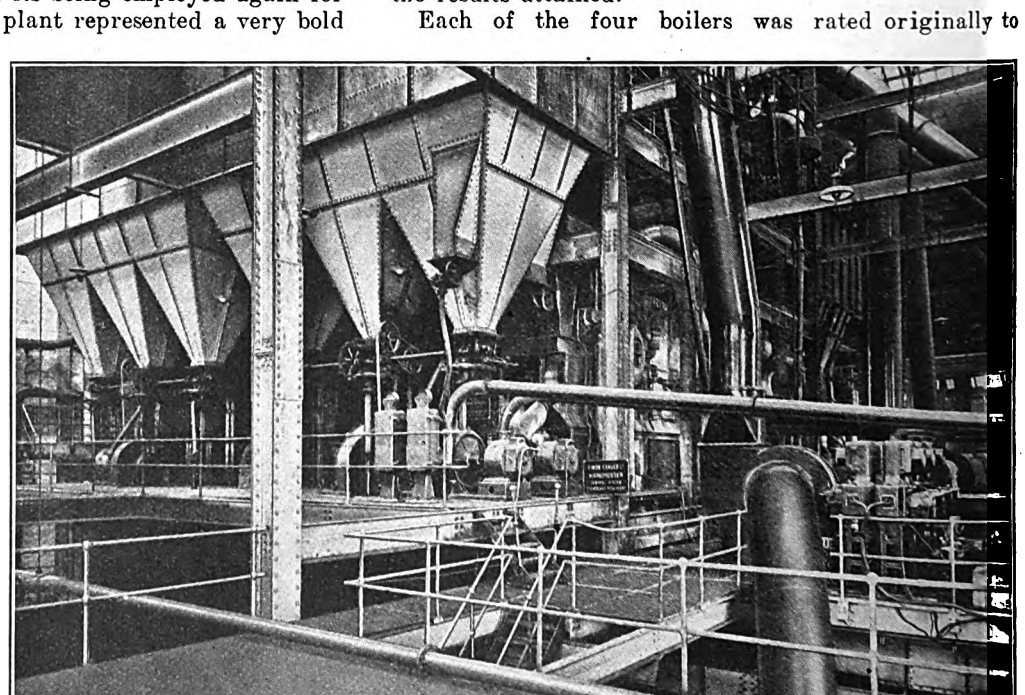

Fig. 2.—General View of Boiler Installation.

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boiler stop valve. The thickness of the steam drum plates is 1½ in., and of the mud-drum plates 1 3/16 in., the diameters of the respective drums being 4 ft. 6 in. and 3 ft. 6 in. All the tubes in the combustion-chamber walls and boiler are 3¼ in. outside diameter, the first three rows of the boiler tubes being 6 gauge solid cold-drawn, and the remainder 7 gauge hot-drawn.

Each half of the boiler is provided with a " Foster "

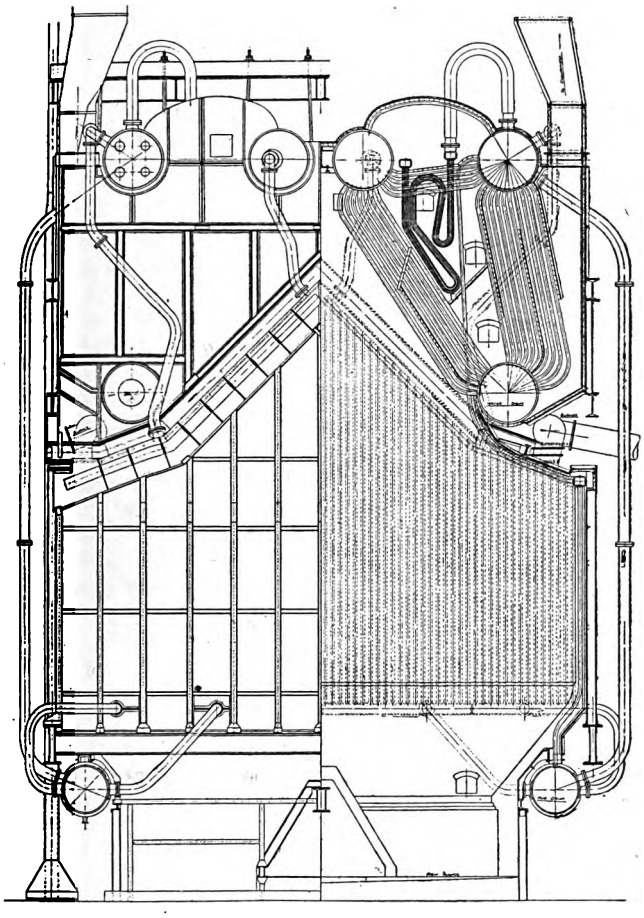

Fig. 3.—Elevation and Section of Boiler and Combustion Chamber.

economiser having an effective heating surface of 3,672 sq. ft., or 7,344 sq. ft. for each boiler unit. The two economisers are together capable of heating 150,000 lb. of water per hour from 180 deg. F. to 236 deg. F. The jointing of the tubes into the economiser is made by expanding them into the header plates, which are outside the zone of the hot gases. An obvious advantage of this design is that repairs, even the removal of elements, can be effected by by-passing the feed water past the economiser, thus obviating the provision of a by-pass flue for the flue gases and enabling repairs to be carried out with the boiler in full commission. The arrangement of the economisers permits a maximum of compactness in the necessary casing, compared with other economisers of similar duty, and makes for a minimum loss due to air leakage into the casing. The superheaters, of which there are two per boiler, each have 2,730 sq. ft. of heating surface. The tubes are of a heavy gauge and are bent cold and subsequently annealed. The superheaters are slung from the top drums from channels attached to the latter. The boilers are fitted with feed water automatic control, as well as hand control, and the level of the water in the boiler is steady at all loads.

The combustion chamber is arranged with water-cooled walls on all sides. Downcomers from the outer steam drums pass to the mud drums, and from these drums uptakes feed the bottom headers on all sides. The headers supply rows of tubes on each wall, and these tubes pass into top headers. These are connected to the steam drums by intakes on each side wall, and by a series of roof tubes extending up through the first nest of boiler tubes and expanded into the outer steam drums. The roof tubes are exposed to the radiant heat of the combustion chamber, the roof blocks being laid upon them; the tubes thus contribute appreciably to the heating surface.

The heating surfaces per boiler unit are: boiler, 16,440 sq. ft.; combustion chamber tubes, 4,700 sq. ft.; total net effective heating surface, 21,140 sq. ft.

The wall tubes were originally covered with a lining of specially shaped refractory blocks keyed round them, so as to hold each other in position. At the instance of Mr. Chattock, in an attempt to get higher efficiencies and to obtain powdered ash and obviate slagging in the chamber, it was decided to bare the water tubes, leaving a refractory wall immediately behind the tubes. The bare tube and refractory surface is so proportioned that sufficient radiation surface exists to obviate any liability of quenching the flame, either in starting up the boiler or at low load. At the same time sufficient bare-tube surface is available to avoid slagging of the ash and consequent damage to the refractory walls in the event of high loads being carried. The results obtained on the first boiler to be converted to bare tubes have fully justified Mr. Chattock's experiment, and a life of five years is expected for the combustion chamber before any renewals are necessary. The arrangement just described, while retaining simplicity in design, combines the main objects of both the all-steel and the all-refractory water-cooled wall, without possessing their drawbacks. As was to be expected, experience has shown the disadvantages of the all-steel wall to be (*a*) the quenching of the fuel particles in the excessively cold zone adjacent to the walls, and the attendant danger of " blowbacks," particularly during lighting-up and low-load periods; (*b*) excessive carbon in the ash. The disadvantages of the refractory wall are (*a*) the limitation of load due to risk of failure of refractories with excessively high CO_2 contents in the flue gases; (*b*) wear and tear due to ash slagging on the walls, particularly with low fusibility ash; and (*c*) bricks supported on the tubes by bolts and clamps complicate the combustion chamber and render repair or renewal of the chamber a difficult matter, necessitating a protracted shut-down of the boiler.

Fig. 4 gives a section showing the arrangement of the different layers constituting the insulation of the boiler, which are as follows: refractory bricks; asbestos mattress; air space; and mild-steel panelling.

This method of insulation is remarkably effective as the

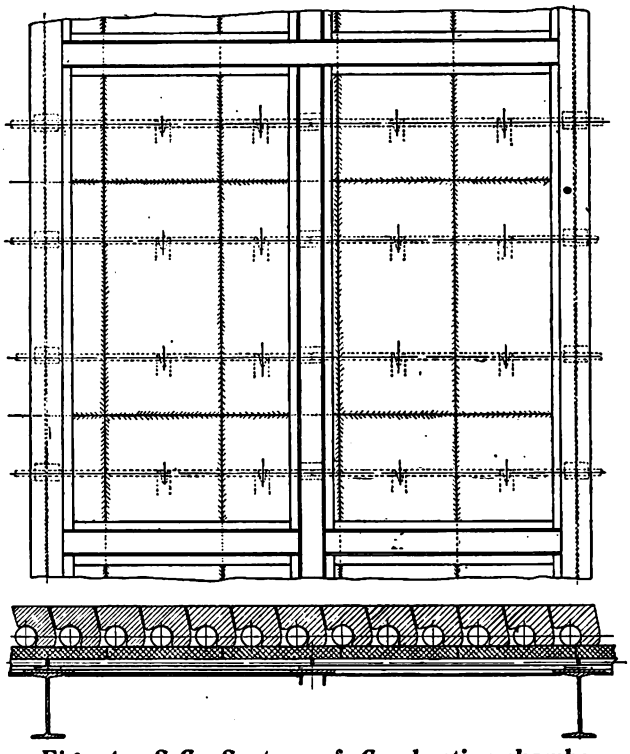

Fig. 4.—S.C. System of Combustion-chamber Insulation.

negligible radiation losses as set out later in test figures will show.

Four dryers of the rotary type are installed, each consisting of two concentric cylinders 6 ft. 8 in. in diameter and approximately 45 ft. long, slightly inclined to the horizontal, fig. 5. The dryers are fired by means of pulverised fuel, the drying gases passing down the inner

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cylinder and back through the annular space where they come into direct contact with the coal travelling in the opposite direction. The coal is lifted by vanes on the outer shell and poured on to the hot central tube; it is held in contact with the tube surface for a short period as the dryer rotates by vanes mounted on the tube. The

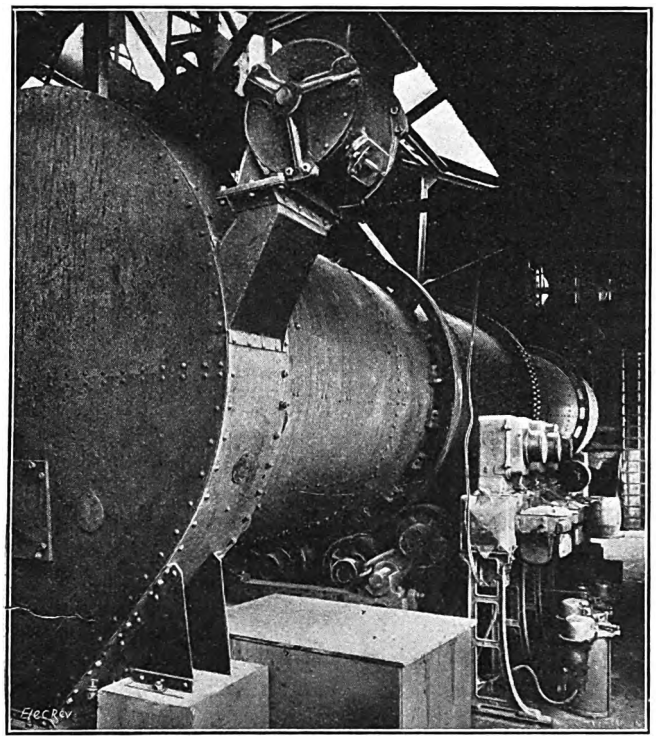

Fig. 5.—One of the Rotary Dryers.

coal on leaving the dryer is delivered by elevator and conveyor to the raw-coal bunkers in the boiler house. Originally the waste gases from each dryer were exhausted by fans and delivered to two cyclones in series. With a view to minimising the emission of fine coal into the atmosphere the cyclones have been discarded and electrostatic precipitators installed in their place. These have resulted in an appreciable saving in coal which will quickly enable the additional capital cost of the plant to be recouped.

The emission of dust from this plant is absolutely negligible, and a rough test has shown that the efficiency of the plant is over 99.0 per cent. The following capacity data concerning each dryer are of interest:—

Total Moisture Content of Raw Fuel.		Capacity of Dryer in Tons per Hour.
20%	...	12
15%	...	18
10%	...	24

Total moisture content of dried fuel is 1½%.

Normal temperature of ingoing drying gases entering inner shell is 1,000° F.

Normal temperature of ingoing drying gases entering annular space is 700° F.

Normal temperature of outgoing drying gases is 175° F.

The drying gases are obtained by burning pulverised fuel in a combustion chamber adjacent to each dryer, the fuel being delivered from the pulverised-fuel bunker in the boiler house by a current of air from a special pulverised-coal fan. This arrangement obviates the provision of pulverised-fuel storage in the dryer house.

Four air-swept ball-mill-type pulverisers are installed, each capable of pulverising 12 tons of coal per hour (see fig. 7). Each mill consists of a cylindrical steel casing, approximately 12½ ft. long by 7 ft. in diameter, fitted with manganese-steel liners. The casing is charged with 17 tons of hard-steel balls, having at the outset diameters of 50 and 40 mm. The casing is carried on large trunnions and is rotated through reduction gearing at 21 r.p.m. by a constant-speed motor. When the coal has been pulverised to the requisite fineness, a specially designed exhauster fan picks up the coal and delivers it through a separator to a cyclone, the oversize being trapped by the separator and returned to the mill. The return trunk from the cyclone is divided and delivers the air to the inlet and outlet ends of the mill in quantities determined by a series of dampers in the system, so that the air stream sweeping the mill can be regulated to give the correct fineness of the product.

When the total moisture in fuel fed to the mill does not exceed 1½ per cent. the analysis is as follows: on a 100-mesh sieve, not more than 5 per cent.; on a 150-mesh sieve, not more than 15 per cent.; on a 200-mesh sieve, not more than 20 per cent.; and through a 200-mesh sieve, not less than 80 per cent.

These degrees of fineness can be maintained for 5,000 hours at full working load, with only an occasional addition of balls and without renewals of wearing parts of the mill. The grinding balls over a lengthy period showed a loss of only 2.8 oz. per ton of coal milled. Mills having pulverised 60,000 tons of fuel each have not required any renewals of the lining plates. Experience has shown that this type of mill, though more expensive in prime cost and power consumption than some other types, is, due to its being a low-speed machine with no internal working parts requiring lubrication, very economical in upkeep and extremely reliable in operation.

From the mill the fuel is taken by air to the cyclone collector, the air returning from this to the mill. The air system forms a practically closed circuit, being vented only to the combustion chamber, and thus eliminating any dust nuisance. From the cyclone collectors the pulverised fuel is taken direct to the bunkers, but by means of two screw conveyors any bunker can be fed from any of the mills if required. There are eight bunkers, two to each boiler, each holding 50 tons of pulverised fuel. These are fitted with hand-operated mechanism to denote the height of the fuel in the bunker. It is worthy of note that although pulverised fuel has been stored for a period of five months before one of the boilers has been put into commission, and when the boilers have been laid off for protracted periods, no

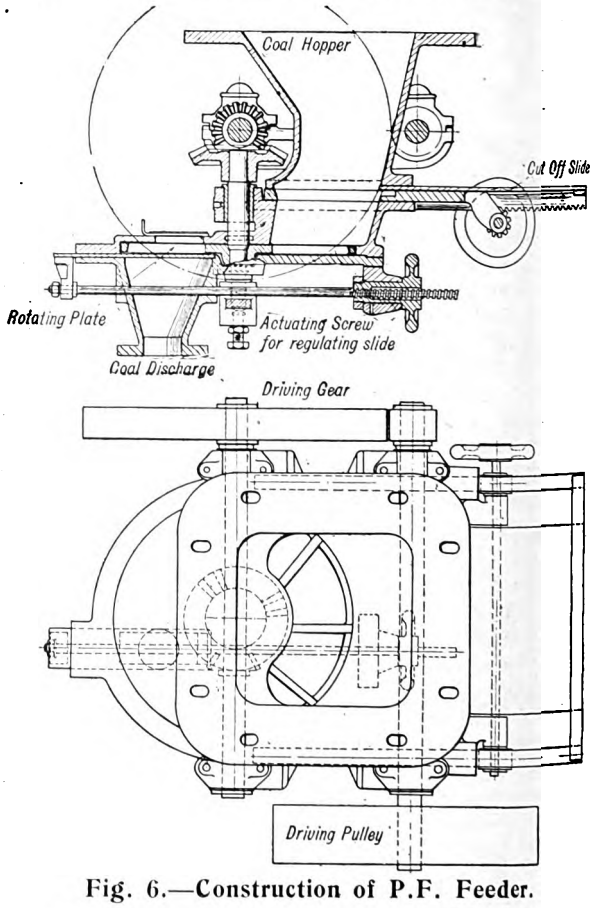

Fig. 6.—Construction of P.F. Feeder.

spontaneous combustion has occurred, the extreme dryness of the fuel, no doubt, being largely responsible for this. The inclination of the bunker sides is such that with correct drying, holding up, arching over, and/or piping of the pulverised fuel do not occur during the evacuation of the bunker.

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The fuel feeders, fig. 8, are of the rotating-plate type, each bunker supplying three of these feeders. Fig. 6 shows clearly the construction of these feeders, from which the coal is delivered by gravity, assisted by a stream of inspired air to an injector in the primary-air mains, fig. 9, of which there are six per boiler, each

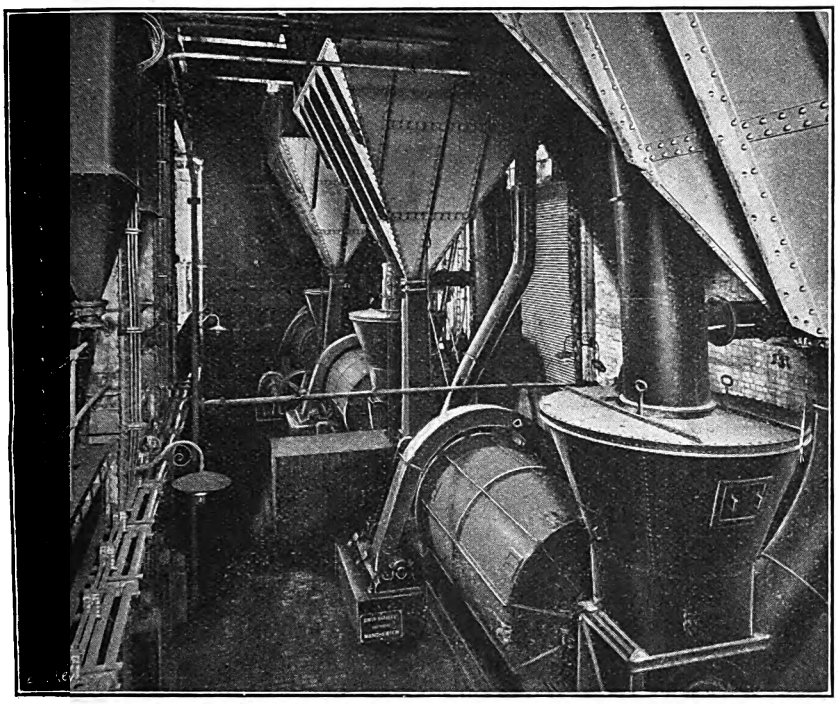

Fig. 7.—The Ball-Mill Pulverisers.

primary-air fan supplying three feeders. The mixture of coal and primary air is met by the secondary air, supplied by two fans per boiler, close to the mouth of the burners. The admission of all secondary air to the burners makes for the maximum combustion efficiency, minimum flame length, and simple control of air supply.

Six burners are fitted to each boiler, three at either end of the combustion chamber, the number of burners alight at one and the same time depending on the boiler load. As much as 7,300 lb. of coal per hour is passed through any one of these burners, if required. The burners have plain rectangular nozzles, but above the nozzles are cast-iron cylindrical mixing chambers designed to give a sharp change of direction from the horizontal to the vertical. In this way the maximum turbulence is achieved without sacrificing simplicity. Turbulence is also promoted after the fuel-air stream has left the burner mouth by causing it to impinge on the refractory covers placed over the roof tubes, thus splitting up the stream into jets. Experience has shown that these burners give sufficient turbulence, consistent with complete combustion, and has led to the adherence to this type of burner. The flame length is minimised by the requisite degree of fineness in the fuel, while retaining the simplest design of burner. The burners project the stream of fuel-air nearly vertically, thus giving the ash every opportunity to discharge into the ash pit instead of being carried up into the convection zone of the boiler.

Lighting up is exceedingly simple and reliable, and consists of lighting a torch and paraffin jet (operated by a compressed-air ejector) and directing it to meet the fuel stream, from the lighting-up door situated in the side of the boiler below the burners. Parry steam blowers are installed on the boilers, and these keep the boiler passes free from bird-nesting. These blowers are operated by saturated steam at boiler pressure, and the nozzles are of such a design as to convert the full pressure of the steam into velocity, thus setting up practically no excess pressure in the combustion chambers.

The ash falls by gravity into two 18-in. diameter semi-circular water-swept troughs, which are lined with cast-iron. These convey the ash to a settling pond from which it is removed by an overhead grab running on a telpher and discharged into barges. The circulating pumps draw off the clarified circulating water from the settling pond and recirculate the water around the system. The water is clarified by means of decantation in the settling pond, from which the water passes out through a sieve.

With correct proportioning of air and coal remarkably good combustion is obtained, as is evidenced by the absence of combustible matter in the chamber ash.

A certain amount of combustible matter is inevitably carried over into the flue dust, but the percentage is normally below 0.7 per cent. of the total fuel burnt in the case of the boilers with covered tubes, and 0.9 per cent. with the bare tubes. The maintenance of steady CO_2 at varying loads is a very valuable feature of pulverised-fuel plant, especially in a large power station, and is an advantage not possessed by chain-grate stokers. With the above mentioned chamber the ash which is recovered in the chamber is all in the powdered form. Another advantage with the bare-tube combustion chamber is that normal loads and overloads can be maintained for indefinite periods at 17 per cent. CO_2 without any deleterious effects on the chamber or boiler. In lighting up from cold in the case of emergency a boiler can be put on the range in 30 minutes. Great flexibility in the running of the boilers is attainable between light and heavy loads, the response to steam demand being almost instantaneous. This is a great advantage of pulverised-fuel firing in a power station, and one of which its rival, the mechanical stoker,

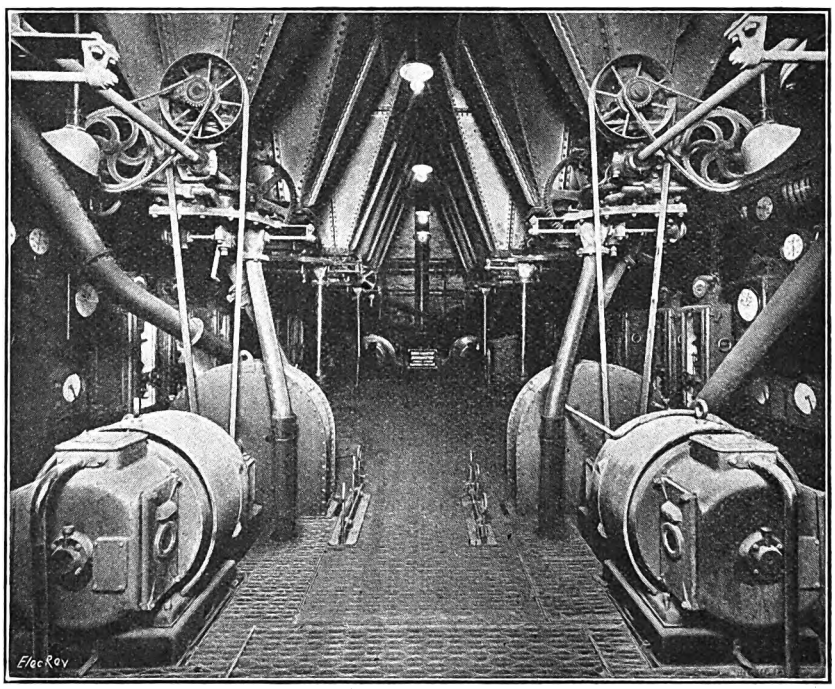

Fig. 8.—Control Platform, showing P.F. Bunkers and Feeders.

is incapable. The following instruments are provided for each boiler; steam-pressure gauge, superheat temperature recorder, Bailey steam-air-flow recorders, temperature recorders for boiler and economiser exit gases, Kent steam-flow meters, feed-water temperature recorders at inlet and outlet economiser, and draught gauges for

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the combustion chamber, boiler, and economiser outlets.

The draught for each boiler is provided jointly by two induced-draught fans and a "Pratt" chimney. The plant was designed to produce a draught at the entrance to the chimney of 1.8 in. at normal load, with 78,500 cu. ft. of gases per min., and 2.75 in. at overload, with 100,000 cu. ft. of gases. The induced-draught fans draw the chimney gases through two Davidson grit catchers of the shunt suction type arranged in parallel.

On a 54-hour official test at an average rating of 140,620 lb. per hour, the overall efficiency of the plant, after deducting coal used for drying, and all power consumptions, was 81.1 per cent. gross and 84.75 on the net lower calorific value, while the combustion heat efficiency alone, including the superheaters and economisers, was 84.69 and 88.46 per cent. on the gross and net calorific values, respectively. 84.69 compares with a stoker-fired boiler combustion efficiency of 80 per cent. obtained under similar test conditions. The same figure, though a test figure, is obtained regularly during normal operation of the plant, and therefore compares actually with a boiler-house combustion efficiency of 72 per cent., covering the operation of stoker-fired boilers. The complete test figures are appended.

As evidence of the reliability and efficient operation attainable with correctly designed plant, it may be mentioned that the first boiler converted to bare tubes has now run continuously, carrying a daily overload, except for routine week-end shut-downs for a period up to date of eight months. Another point which should be mentioned is the small number of men employed to run the installation, bearing in mind the size of the plant and the various operations in connection with it.

Draught :—	
Combustion chamber (top of) ...	Plus 0.03 in. water
Leaving boiler	Minus 1.6 in. water
Leaving economiser	Minus 1.92 in. water
Analysis of gases :—	
CO_2 leaving boiler	14.59%
O_2 leaving boiler	4.57%
CO leaving boiler	0.03%
CO_2 leaving economiser	13.51%
O_2 leaving economiser	5.74%
CO leaving economiser	0.03%

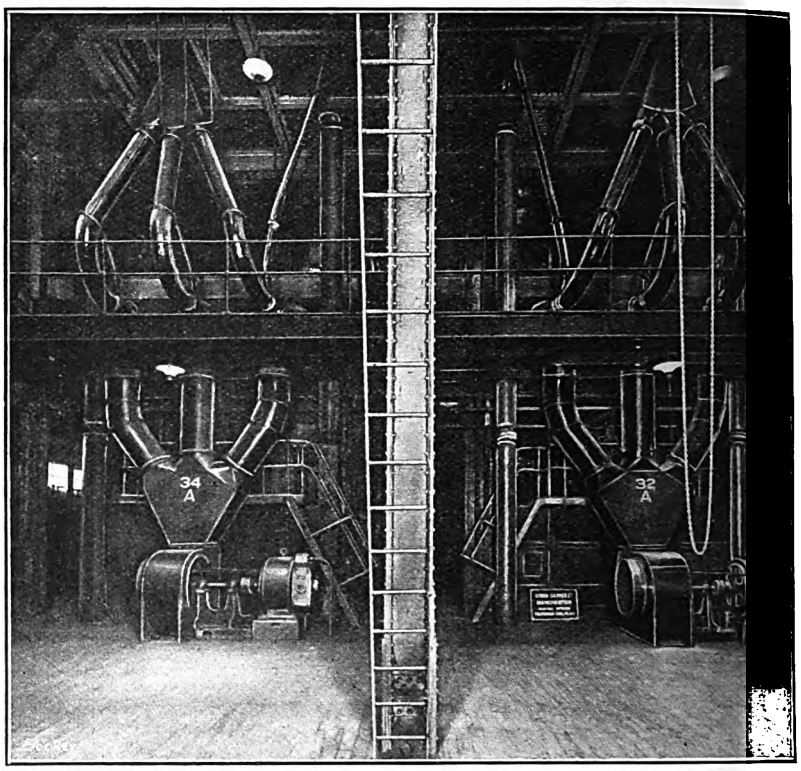

Fig. 9.—Primary and Secondary Air and Fuel Pipes.

Test Data.

Power used on the Plant.—Electrical energy used per ton of coal handled and delivered to fuel burner.

By pulveriser mill at full load ...	14.0 kWh
By fuel-collecting and conveying-apparatus	0.03 ,,
By fuel feeders to the burners ...	2.7 ,,
By coal-drying apparatus	2.44 ,,
By other apparatus	1.38 ,,
	20.55 ,, per ton

Duration of test—steaming hours ...	53 hr. 40 min.
Normal duty of boiler	150,000 lb./hr.
Overload duty of boiler	180,000 lb./hr.
Average duty during test	140,620 lb./hr.
Coal as fired :—	
Moisture	3.53 %
Ash	21.56%
Gross calorific value per lb. ...	10,062 B.th.u.
Coal fired per hour	21,231 lb.
Water :—	
Evaporated per hour	140,620 lb.
Evaporated per lb. of coal (actual)	6,623 lb.
B.th.u. per lb. of steam above feed temperature	1,286.6
Temperatures :—	
Air to furnace	60.0°F.
Gases leaving boiler	683.6°F.
Gases leaving economiser	425.8°F.
Water to economiser	160.0°F.
Water to boiler	259.7°F.
Superheated steam	782.8°F.
Pressures :—	
Boiler	322.3 lb./sq. in.
Superheater	317.1 lb./sq. in.

Heat account :—	
Heat absorbed by boiler and superheater	78.12%
Heat absorbed by boiler, superheater and economiser	84.69%
Loss in dry gases	9.52%
Loss in water vapour	4.92%
Loss in radiation, combustible ash, and unaccounted for	0.87%

Diesel Engine Progress in U.S.A.

According to the American editor of the *Financial News*, there are now 45 manufacturers in the United States making Diesel engines, although competition is at the moment so strong that it is believed only a few concerns are working this department of their business at a profit. There is now a total of about 2,000,000 Diesel horse-power at work in the United States, according to a study made by the Standard Statistics Co. In 1928 production of new engines reached 440,000 horse-power, and of all the Diesel power now used in American industry, 20 per cent. is in electric power stations, 25 per cent. in the petroleum industry, 25 per cent. in marine uses, and 30 per cent. in manufacturing, portable and excavating machinery, &c. In the south of America, where fuel oil is cheap, but where electricity costs about 2½ cents per kilowatt-hour, it has been found that electricity can be produced with Diesels for 1 cent per kilowatt-hour. A number of central power stations are installing Diesels for emergency power, and also to be used during peak-load hours. There are now 40 Diesel locomotives on American railways, mainly of the electric generator type, having a maximum speed of 30 miles an hour.

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Are We Running Dry?

Some Considerations Regarding the Amount and Location of the World's Power Resources.

By D. J. BOLTON, M.Sc.(Eng.), M.I.E.E.

SPECULATION as to the possible exhaustion of the world's power resources has always had a peculiar fascination. Every year about fifteen hundred million tons of coal, oil, and other consumable minerals are dug up from the earth and burnt. Their latent chemical energy, which has been thousands

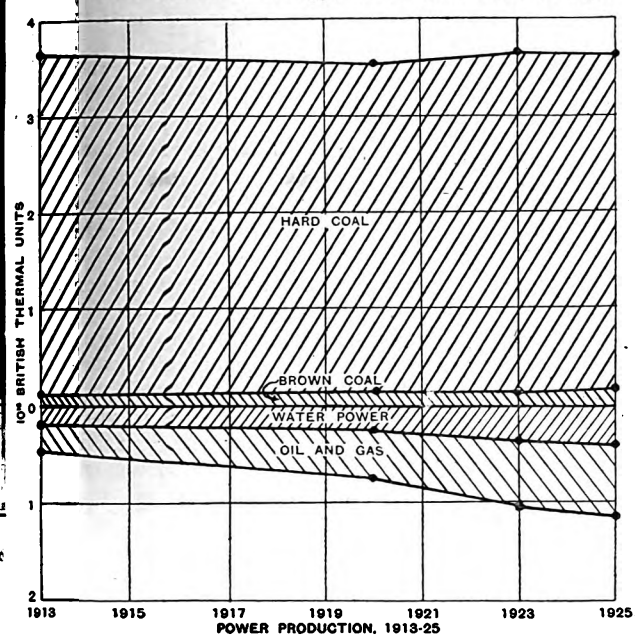

Fig. 1.—The World's Power Production.

of years in the making, becomes in a few seconds turned into heat and dissipated for ever. Such a process clearly cannot go on indefinitely. There is only a certain amount of coal and oil in the earth, and it is not being added to in any appreciable degree. Moreover, even of this total, some can only be obtained with great and increasing difficulty.

It is therefore not surprising that questions of the inevitable final exhaustion of the earth's mineral wealth should have occupied the minds of thoughtful engineers from the very early days of fuel getting. In scientific circles prophecies regarding the end of the coal and oil supplies hold somewhat the same position as phophecies about the end of the world hold in religious circles. In fact, so far as engineers are concerned, the end of the power resources *is* the end of the world—*their* world that is. No doubt the race could continue to exist by reverting to a more primitive mode of life and with a very much smaller population, but engineering, and in fact civilisation as we know it, would cease to exist, since there would be no leisure or relief for anyone from grinding physical toil. Moreover, just as there have been fervent religionists who have foretold a rapidly approaching end to the world, and have even determined the day and the hour, so there have been scientific alarmists who have foretold the rapid exhaustion of our power supplies. Fortunately in this case we depend on something more exact than the hopes and fears of human credulity, and, although wild shots have been made, data are now accumulating for a tolerably accurate forecast.

In a recently published book, *Power Resources of the World*, compiled by the World Power Conference, all the existing data on the subject of world power resources have been reviewed, and much of it reprinted in convenient and accessible form. The figures utilised below are those published by the American Bureau of Mines (Fig. 1) and the Dresdner Bank (Figs. 2 to 4). Both sets of figures are reprinted in this book, which also compares and criticises the methods of estimation employed by the various authorities.

The three main sources of power are coal, oil, and water. With the oil it is convenient to group the sources of natural gas, which are found in many places. With the coal may be included not only hard coal, but also brown coal, shale, &c. In order to give some idea of the relative importance of these three, it may be said that at present three-quarters of the world's power and heat comes from coal, 15 per cent. from oil, and only 5 to 8 per cent. from water. This last figure is in some doubt, since there are various ways of estimating water power and of comparing it with coal and oil. The authorities here illustrated give the higher figure, but there are reasons for believing this estimate too high. In any case it will be seen that, although oil and water power have increased, and are increasing rapidly, they still account for only a quarter of the total, and there is no prospect whatever of their ousting coal from the premier place.

Dealing first with this question of annual power production, fig. 1 has been prepared to show graphically how this has varied in recent years, and also to show the proportions of the different groups. In this figure the various sources of power have all been brought to a common basis of calorific value. Coal is plotted above the horizontal zero line and is divided into hard coal and brown coal. Oil and water power are plotted below the line, and the vertical width of each belt represents the magnitude of that group in heating power. The outstanding feature of coal is that the total world

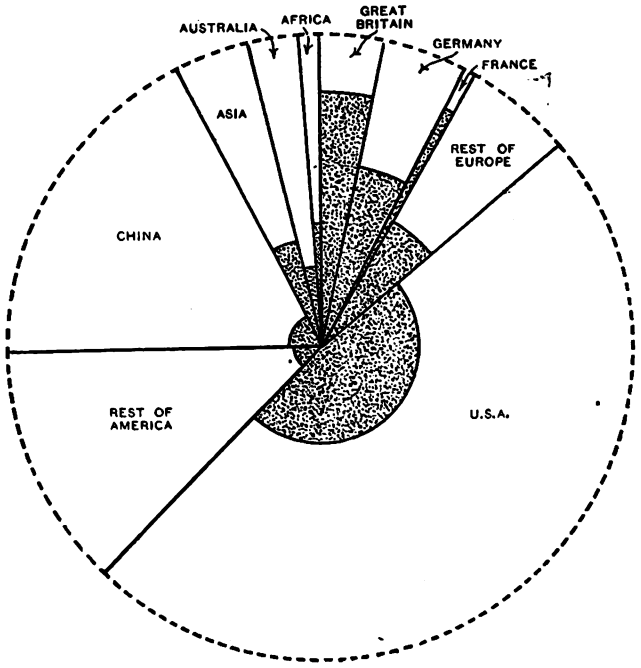

Fig. 2.—Coal Resources and Production.

production has been practically stationary since 1913. This does not apply to soft coal which, as will be seen, only represents a very small item as compared with the hard coal. Oil and water power have increased steadily, and each of them has more than doubled in the period shown.

Turning now to the question of future resources,

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estimates differ widely, and in some cases it is very difficult to make more than a rough guess. The conclusion of the book referred to above, after an exhaustive review of existing data, is that further reviews are necessary in the case of very many of the fields. In several instances two or more estimates are available which differ so much that it is difficult to attach much value to any of them. Nevertheless, some tentative conclusions can be drawn. In the case of coal the world's total coal reserves are estimated at some five billion

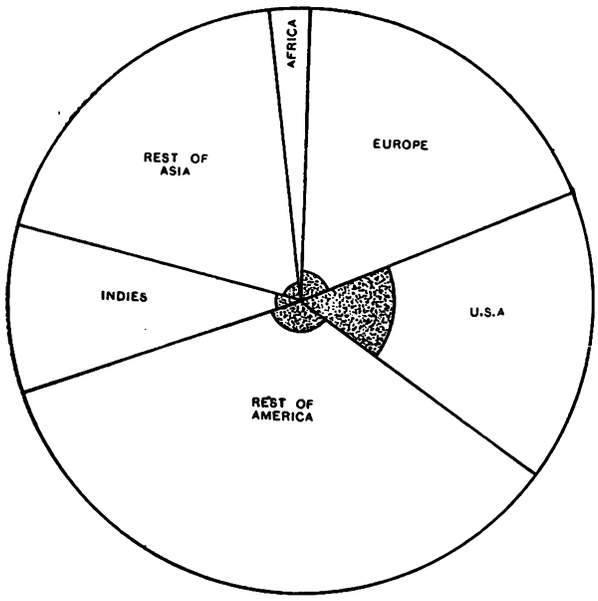

Fig. 3.—Available Oil and its Production.

tons, which is something over four thousand times the present annual rate of consumption. Even assuming that some of this coal cannot be won without excessive labour, there still appears to be very little cause for immediate anxiety. It would seem, in fact, that, as regards coal, the end of the world is not very close at hand, and apparently, like Mark Twain, the reports of its death have been much exaggerated!

In fig. 2 the estimated coal reserves for the whole world are represented by the area of the large dotted circle, and this is divided up beween the different continents and more important countries. The darkened central areas in each case represent annual production to 500 times the scale.

Considering next the question of oil resources, here the situation is not quite so promising. Not only are the resources much less in proportion to the annual consumption, but this consumption is rapidly on the increase. However, even here things are not so bad as they are sometimes made out, and it appears that some of the published estimates owe more to the heat of propaganda than to the pure cold light of science. In fact, if certain reports regarding the U.S.A. are to be believed, the total resources there are only two or three times the annual production! Making use of more reliable estimates, and taking the world over, it appears that the total surveyed resources amount to some forty times the present annual production. If these estimates are final, and if the production continues to go up at its present rate, there will be a very drastic check and readjustment of the world's power methods within the present generation. This applies not merely and not so much to large-scale power production as to the smaller units, and particularly to road transport. But whilst these estimates are the best now available, the experience of the past is that new sources are discovered as fast as the old ones become exploited, and it may be that in forty years' time the estimate will still stand at forty years ahead!

In fig. 3 the area of the outer circle represents total oil resources and the inner darkened sectors represent annual production to the same scale. These areas are divided up radially as before into the different continents, &c. It will be seen that it is only in the U.S.A. that the rate of exploitation gives any immediate cause for alarm. As regards the very large deposits in other parts of America, in Asia, and in Europe, the rate of exhaustion is still quite small.

Dealing finally with the question of water power resources, fig. 4 shows these to the same scale as the previous figure. As before, the outer circle represents total potential resources, whilst the inner blackened sectors show the extent to which these resources have been realised. At first sight the position here may appear more serious than in the case of the other two, since the potential resources are less and the degree of realisation is greater. But it must not be forgotten that the potential resources in this case are *annual*, not total. The inner black areas could expand until they filled the total outer circle, and the power developed could be maintained *every year* at this rate. In the case of coal and oil, the outer areas represent total resources, and once these are completely realised they are exhausted for ever.*

It is interesting to note that the potential annual water-power resources represent about 25 per cent. more than the total annual power production (coal, oil, and water) at the present day. This means that water power alone, if fully realised, is capable of supplying all the world's present power needs with a substantial margin. Unfortunately, many of these needs are not readily transportable, while the water power itself is distributed in a manner very different from the distribution of population and needs.

The only question so far considered is that of the possibility of future exhaustion in the world as a whole. But almost more important than this time element in power resources is the place element. In spite of the marvels of modern transportation and high-tension electrical transmission, there is still great difficulty in the large-scale transportation of power. This difficulty is frequently sufficient to tip over the balance of trade and divert orders into channels which they would not otherwise occupy. When, therefore, the distribution of power resources does not correspond with the distribution of either population or industrial needs, the fact is important and possibly vital to the future peace and development of the world. In the past, the densest populations have chiefly grown up either where the living requirements are easy, as in Asia, or where coal is plentiful and readily accessible, as in Central and Northern Europe. In these centres have developed characteristic civilisations, the one agricultural and the other industrial. Now that coal fields are being developed in fresh areas, and that other forms of power are becoming available, a new orientation emerges and may become inevitable. We natives of Europe and the North American continent have generally regarded ourselves as the hub, at least of the industrial universe, and it is somewhat mortifying to discover that much of the world's potential power resources lie outside our areas.

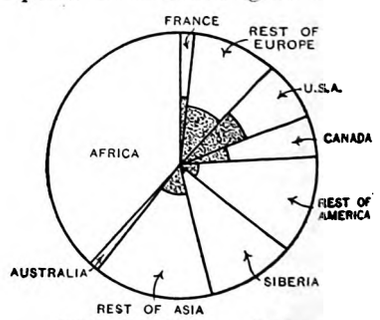

Fig. 4.—Water Power Resources and Use.

Finally, whatever our politics or point of view, whether imperialist or humanitarian, we shall at least agree as to the vital importance of a scientific study of the world's power resources. With a sane and ordered exploitation and utilisation, it is possible for the vast riches of the earth to yield a fruitful legacy for every one of its inhabitants: the legacy of a standard of living and leisure hitherto unknown. If it becomes a mere game of grab, a tug of war between rival combines and narrowly conceived personal interests, these same riches may be fought over and squandered, leaving nothing but extravagance for the few and misery for the many. The first step is to survey and study.

* As regards the scales of figs. 2 to 4, a given area represents a given number of tons or equivalent tons per annum. The same scale is used for all parts of figs. 3 and 4 and for the centre portions of fig. 2. The outer part of fig. 2 is 1/500th of this scale, and is therefore dotted.

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The G.I.P. Railway.

Electrification of the main lines from Bombay to Poona and from Bombay to Kalyan: the lines traverse difficult mountainous country and constitute the most extensive railway main-line electrification scheme within the British Empire.

(*Concluded from page* 896.)

Locomotives.—With steam operation it was usual to haul the longest possible freight trains from Bombay to Karjat or Kasara, and to break them up at those points into smaller trains which could be conveniently worked over the Ghats. Electric trains are made up of such a weight that they can be hauled right through without remarshalling, the maximum loads being fixed at 1,000 tons from Bombay and 1,600 tons towards Bombay. Steam locomotives will be retained for some of the shunting and the marshalling of trains.

On the Ghats two electric freight engines are used, each capable of exerting a tractive effort of 50,000 lb. (on test up to 85,000 lb. was exerted), but elsewhere only one is required. The design provides for six driving axles, there being two trucks each with three coupled axles. The two trucks are pivotted and are also joined together by means of a flexible articulated coupling. The length over buffers is approximately 66 feet, the rigid wheel base 15 ft. 1 in., and the wheel diameter 48 in. There are no carrying axles, and the total weight which is rather more than 120 tons is all available for adhesion.

Each truck contains a pair of motors geared together on to a single intermediate jackshaft. The power is transmitted from the jackshaft to the road wheels by means of connecting rods. The total horse power of the four motors in each locomotive is 2,600.. The motor bearings are of the ring lubricated type, and their operation has so far been particularly successful.

There is a driver's compartment at each end of the engine, but, except for master controllers and a few small switches, the whole of the control equipment is housed in a high tension compartment in the middle. The control is of the electro-pneumatic type and the four motors can be grouped in series, series-parallel, or parallel, thus giving speed combinations of one-half, three-quarter, and full speed. With two stages of field control, there are in all nine economical running positions in addition to starting notches. The control has been arranged for regenerative braking; by this means the excessive wear which used to take place on the rails and also on the tires and brake blocks when coming down the Ghat gradients will be very considerably diminished. Each engine can exert a retarding effort up to 45,000 lb.

The braking system adopted is a combination of the vacuum and compressed air system. The brakes on the engine are actually applied by compressed air, but the flow of air is controlled by the movement of the same vacuum brake handle which applies the vacuum brakes on the train by means of a proportional valve.

Forty-one freight engines were ordered from the Metropolitan-Vickers Electrical Co., Ltd., the mechanical parts of the first 10 being built by the Swiss Locomotive Machine Works, and the remaining 31 to the same design by the Vulcan Foundry. The engines were despatched in parts, and were erected at the railway workshops at Parel. More than half of the engines are now in use, a large number of them having been in satisfactory service for more than a year.

In order to ascertain the best type of passenger engine for the conditions prevailing in India, three different types were ordered, one each from the Metropolitan-Vickers Electrical Company, the British Brown-Boveri, Limited, and the General Electric Company, Ltd.

Exhaustive tests were made in 1928 by the chief mechanical engineer and Messrs. Merz & Partners, and the order for the remaining 21 engines was placed with the Metropolitan-Vickers Electrical Company. All the engines were erected at the railway workshops at Parel.

The tests showed the engine to ride without oscillation at speeds up to 80 miles an hour, with riding qualities that were equally good in either direction.

The passenger engine is unsymmetrical, there being two carrying axles at one end and one at the other. The weight of the superstructure is transferred to the bogie truck through a fore and aft equaliser with hemispherical pivots. The single carrying axle at the other end is combined as a truck with the adjacent driving axle, the arrangement being known as a "Java Truck." The flexibility in the driving mechanism between the motors and the axles allows the driving axle to follow the movements of the truck, notwithstanding that the motors are mounted in the superstructure of the engine. The angular movements of the trucks are spring controlled.

The total weight is 102 tons, of which rather more than 60 tons is on the three driving axles. The weights on the axles are equalised into two groups, the two bogie axles constituting one group and the three driving axles and pony axle the second. The length over buffers is 53 ft. 6 in. and the rigid wheel-base is 7 ft. 6 in., *i.e.*, the distance between two driving axles. The driving wheels are 63 in. diameter and the carrying wheels 43 in.

Each engine has six motors of the total horse power of 2,160. Each driving axle is driven by two motors mounted in line across the engine with their pinions driving separate gears on a common intermediate shaft. On the centre of this intermediate shaft is a spur wheel, which gears directly to a further spur wheel encircling the driving axle, but carried in bearings which are part of the frame of the engine. Between this encircling spur wheel and the axle are links which give a flexible drive of uniform angular velocity. This arrangement reduces the unsprung weight to a minimum, and allows the motors to be placed in a position where they are readily accessible and raises the centre of gravity of the engine, a feature of special importance for smooth running at high speeds.

The control is electro-pneumatic, as in the case of the freight engines, but no regenerative braking is provided, as trains ascending and descending the Ghats will be assisted by freight engines. Since there are six motors, the speed combinations will be one-third, two-thirds, and full speed, but the use of the two field taps provided will permit variations on these so that there are in effect nine economical running speeds. The characteristics of the motors enable them to share the loads properly with the freight engines when hauling trains together over the Bhore Ghat. Passenger train engines will not be required to go over the Thull Ghat, all trains being dealt with on this Ghat by freight engines.

A driving cab is provided at each end with a central gangway down the middle of the engine. The high tension apparatus and the resistances are housed in separate compartments on either side of the gangway. The resistances are cooled by natural ventilation.

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An All-Electric Country House.

"The Bungalow," Frensham Heights, Surrey.

SELDOM, if ever, is electricity used in the home upon such a generous scale as it is in the residence of Mr. P. S. Douglas-Hamilton, "The Bungalow," Frensham Heights, Surrey. This modestly-named place comprises about 40 rooms and is beautifully situated on the Surrey - Hampshire border about three miles from the town of Farnham.

We are not competent to speak with authority upon its architecture, but we may say that it has an extremely pleasing appearance (as will be judged from the view in fig. 1) and is very well laid out. It was built by Messrs. H. Field, of Frant, Sussex, under the supervision of Mr. H. A. Hooker and to the neatly compact design of Mr. L. S. Hatchard, of Tunbridge Wells.

Fig. 1.—"The Bungalow," Frensham Heights.

The electrical installation provides a total load of about 120 kW, and energy is supplied by the Farnham Gas & Electricity Co. at 2,000 V 3-phase, the supply being stepped down to 230 V in a transformer station in the basement of the house. Probably the most remarkable feature of the installation is the switch-room which adjoins the transformer room. So far as possible the load has been evenly distributed between the three phases. The main switch-fuse is an "M.E.M." three-pole pattern designed for 200 A per way. The water heating and cooking main switch-fuse is of William Sanders & Co.'s manufacture, arranged for 60 A per pole. The lighting is controlled by a Berry "Viking" switch-fuse, and Ferranti meters are employed on each phase.

A large part of the load is due to the "Unity" tubular heater system (Young, Osmond & Young, Ltd.), which is employed in all the rooms, corridors, &c. In every position the heaters are controlled by "Satchwell" thermostats which can be set to act over a wide range of temperatures. The result is a very uniform and constant temperature throughout the house, and although the total loading of the tubing installed is about 37 kW, this is, of course, not constantly in action. The tubes vary in length from 2 ft. to 17 ft. In the bathrooms and in one or two other positions heating is provided by "Morganite" 500-W panels. Those in the bathrooms are mounted near the ceiling and each has a little pilot lamp to indicate when the current is on.

The "Unity" system is supplemented in the principal rooms by "Magicoal" electric fires. There are eight of these fitted in fireplaces and some were specially designed. Various forms of heat have been provided. In some cases the elements are concealed in trivets standing in their normal position in front of the fire. In other examples the elements are situated in the flue and the radiation from them is projected forward by means of parabolic reflectors made up in the form of smoke canopies. The fires are of excellent workmanship and

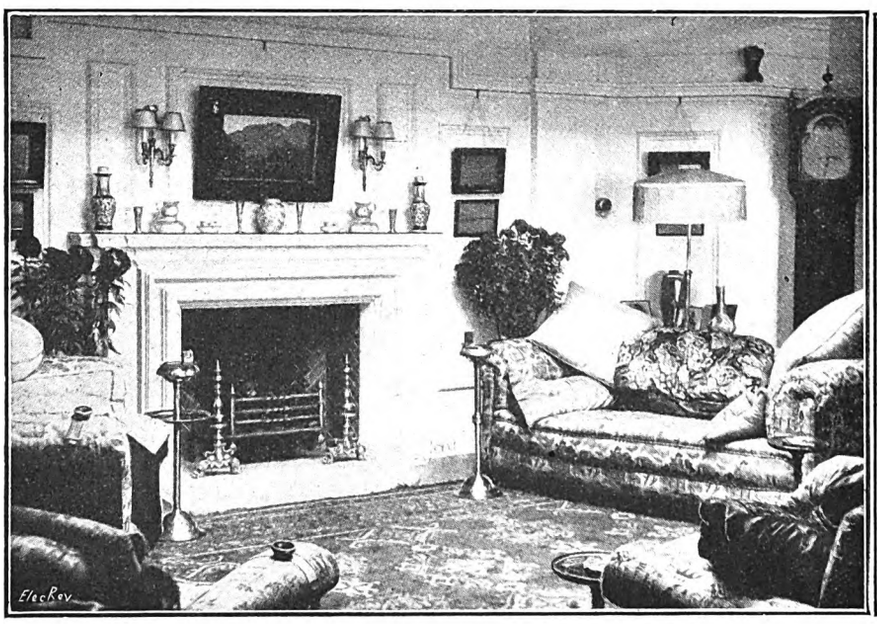

Fig. 2.—The Drawing Room, showing a "Magicoal" Fire.

Fig. 3.—Two Large "Sadia" Water Heaters.

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are designed to fall naturally into the scheme of decoration and furnishing in each room. Fig. 2 is a view of the drawing room showing one of the " Magicoal " fires. The total heating load is about 78 kW.

The " Sadia " water-heater installation consists of fourteen electric automatic water heaters, having a total storage capacity of 346 gallons, at a temperature of 195 deg. F. The total load is 21.3 kW. Each heater is controlled by its own thermostat, so that it is only on rare

Fig. 4.—The " Hotpoint-Falco " Range.

occasions that the total connected load comes on to the supply at one time. The heaters are arranged in positions convenient to the taps which they are to supply. In most cases, particularly for the supply to the principal bathrooms and wash basins, the heaters are enclosed in cupboards; fig. 3 shows two of the larger " Sadias " installed in this way. A separate control board is arranged in the switch room and the heater circuits are run back to it. It is thus possible to control the number of water heaters in use at any one time from a central position. The advantage of this arrangement is that for bathrooms which are used by guests and, therefore, are not required daily, the heaters can be disconnected from the supply and only put into circuit a few hours before the guests arrive. A large storage tank in the roof of the building supplies the various "Sadia" water heaters. A cold water main is run from the tank and the various feeds are tapped off from it to the heaters. The latter are constructed of plain copper sheets, which are welded together to form the containers, a special welding process being used. After test the containers are pickled, tinned thoroughly inside and outside by total immersion in a large vat of molten pure tin, and then fitted in lagged containers.

The principal appliance in the kitchen is a large double-oven " Hotpoint-Falco " cooker (fig. 4), which the makers claim to be capable of catering for from 20 to 25 persons. The larger oven has a loading of 3,000 W and the smaller is rated at 2,000 W, each with three-heat control. There are a large 3,000-W grill and five enclosed boiling plates. The latter comprise three 8¾-in. (1,800 W each) and two 7-in. (1,200-W) plates and are all equipped with three-heat switches. The total loading of the cooker is about 16 kW, and each half is separately wired and switched. The body is black stove enamelled and the hob is blue-black vitreous enamelled. The door panels and feet are white enamelled. Each oven is fitted with a removable interior and a thermometer is mounted upon each door. Near the cooker are two plug points to which kettles, irons, &c., can be connected. In the scullery there is a " Hotpoint-Walker " dish-washer. This comprises a white-enamelled cylindrical tank in the bottom of which is an impeller driven by a small motor. The dishes, &c., are placed in a wire tray in the top of the tank and water is swirled over them at high speed. When the washing is completed the cover is taken off and the crockery is allowed to dry.

" Electrolux " refrigerators have been installed in the butler's pantry and larder, and other electrical apparatus is in use, such as polishing motors, irons and vacuum cleaners. Outlets for the last are provided at convenient points all over the house. There is also installed an " Electrolux " water softener capable of dealing with 2,000 gal. of water of 16 degrees hardness.

Every circuit in the house is brought back to the switch-room and each is separately controlled by a rotary switch and two single-pole fuses. The rotary switches are arranged on the marble panels of four totally-enclosed boards, two of which can be seen in fig. 5. The board connected in the " A " phase deals with 36 heating and cooking circuits; phase " B " board controls heating circuits, vacuum cleaner points, towel rails and six " Sadia " water heaters—36 points in all; and on phase " C " there are two panels—one controlling 27 heating circuits and nine " Sadia " water heaters, and the other 21 lighting and bell circuits. Each switch is numbered, and to facilitate the location of any switch there is a chart upon the wall of the room detailing the various apartments and their circuits, indicating the switch number for each. Next to the switch-room there is a store in which all kinds of spares are kept.

In addition to the equipment in the house the construction is well in hand of an electrically-heated greenhouse. This is a triple structure of large dimensions in teak and " Vitaglass." Here, again, the " Unity " system of heating is to be employed. The equipment will be under thermostatic control operating three-phase contactors.

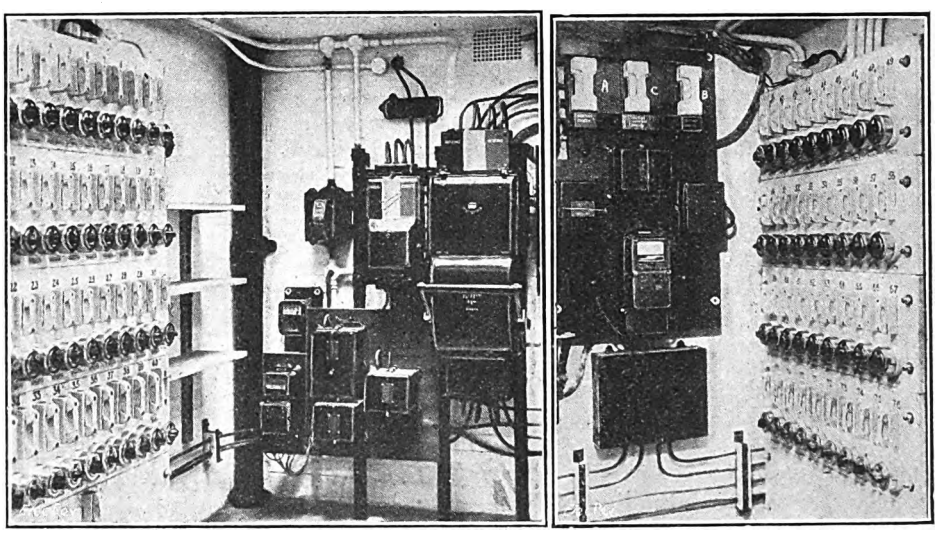

Fig. 5.—Two Views of the Switch Room.

The whole of the electrical work has been carried out by Messrs. F. H. Wheeler, Victoria Street, S.W.1, with the assistance of their engineer, Mr. A. Hulks.

In conclusion, we would express our indebtedness to the owner for his courtesy in permitting a visit of inspection and acting as our guide. Mr. Douglas-Hamilton tells us that when reasonable allowance has been made for the wages of a stoker, the cleanliness, and convenience, there is very little difference between electric and coal heating in the matter of cost.

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Feeder Protection.

A Comparison Between the Effectiveness of the Merz-Price and "Translay" Protective Systems.

By G. R. M. GARRATT, B.A.(Hons.) Cantab.

IN many respects the adequate protection of feeders represents greater difficulties than the protection of individual pieces of apparatus. Whatever form of protection is used for single pieces of equipment, the relay circuits and pilot wires are all short, and accidental tripping, due to capacity currents or to faults on the pilot wires themselves, is most unlikely. Feeder protection, on the other hand, calls for very careful consideration of the constants and construction of the pilot wires and all associated gear, and it may be said that, though numerous attempts have been made to produce a perfect system of protection for feeders under all conditions of load, the attempts have been only partially successful.

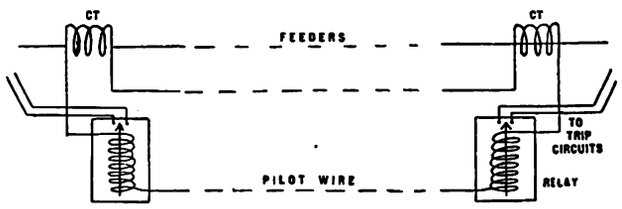

Fig. 1.—Simple Merz-Price Protective System.

The usual method of protection adopted for feeders operates on the Merz-Price principle. Fundamentally, Merz-Price protection compares the current entering a feeder with the current leaving it. Under fault conditions, the two currents will not be identical, and the difference is used to operate relays, which, in turn, trip out the faulty sections.

In practice, current transformers are connected at each end of the feeder (fig. 1). The secondary windings of the current transformers are connected together by means of pilot cables in such a way that the e.m.f.'s generated oppose each other. If the feeder is in a healthy condition, the e.m.f.'s generated in the current transformer secondaries at each end of the feeder will be equal, and no current will flow through the pilot wires. Relays are connected in series with the secondaries at each end of the feeder. Under fault conditions, the opposing e.m.f.'s do not balance, and the resulting current operates the relays, which, by means of the circuit breakers, trip out the faulty section.

Unfortunately, in practice, this system possesses several serious defects. They have all been attacked in different ways, but almost every solution of one problem introduces other difficulties. The defects of Merz-Price protection and the various methods used to overcome them may be summarised as follows:—

(1) Failure of the pairs of current transformers to maintain perfect balance under all conditions of load.—

The very strictest attention to detail is required in the manufacture of the current transformers in order to make certain that they contain exactly similar weights of iron of identical grade. The construction of the core and its joints, and the insulation of the laminations, must receive the most careful attention to insure that correct balance will be maintained, even up to many times full-load current. Incorrect balancing at large overloads is a possible cause for incorrect tripping at times of "through faults." On such occasions, a perfectly healthy feeder, called upon to supply a heavy overload current to some other faulty section, may be disconnected in error.

In addition to the use of very carefully balanced current transformers, a further precaution against accidental tripping on heavy overloads, or through fault conditions, is to give the relay a bias which varies in proportion to the current in the main feeder. This bias is arranged to increase the fault-current setting of the relay. At times of heavy overload, any small out-of-balance current which may exist, due to slight differences in the characteristics of the current transformers, will be insufficient to operate the relays, though a true fault on the feeder itself will still cause perfect operation, since large out-of-balance currents then exist.

(2) Unjustified tripping, due to capacity currents in the pilot cables.—

Under all normal conditions there exists a difference of potential between the two wires of the pilot cable. The inter-capacity of these is often of a large order, and the charging currents must flow through the relay coils. Under healthy conditions these charging currents will be considerably less than the settings of the relays, but, with heavy through fault currents in the feeders, the potential difference in the pilot wires will rise very considerably, and the charging currents may then be sufficiently large to operate the relays.

The only satisfactory method of combating this difficulty lies in the use of specially sheathed pilot cables. In such a cable each of the pilot wires is surrounded by a copper sheath, which is insulated from the wire and also from earth. At some point along the cable, usually approximately in the centre, the sheath is broken. The ends of the two halves are then connected between a relay and a current transformer, so that the charging currents flow through the transformer secondary, but not through the relay. In practice the use of these specially sheathed cables has proved perfectly satisfactory, but the cost is 40 per cent. to 50 per cent. above that of an unsheathed cable.

(3) Accidental tripping due to surge currents in the main feeders.—

Generally, the inter-capacity of the feeders themselves

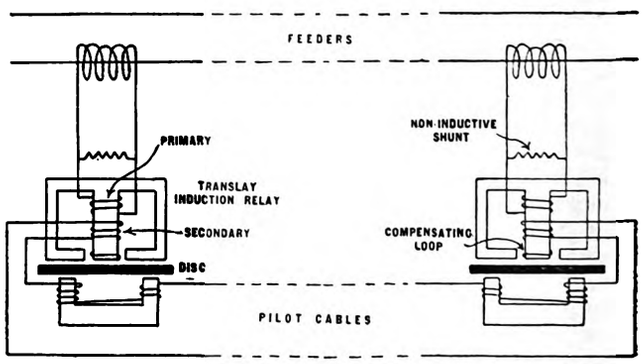

Fig. 2.—"Translay" Protection on Single-phase Feeder.

is of a low order, and charging currents will, therefore, be of too low an order to operate the protection gear. With very long feeders, however, this is not always the case, and transient charging currents, due to a voltage surge, may momentarily produce the effect of an actual fault on the feeder. Owing to the capacity of a feeder being a distributed one, a charging current must obviously be greater at the "near" end than at the "far" end. A voltage surge is generally caused by a momentary fault on the system; a drop in voltage results, and as the fault clears the voltage may rise again

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very suddenly. Extra heavy charging currents are caused thereby in the feeders, and on a long line where the capacity is above the average they may be large enough to operate the relays.

Under surge conditions the charging current usually has a high frequency. The coils of the relays are highly inductive, and it is therefore possible, by connecting a non-inductive resistance across the relay coils, to by-pass the high-frequency charging currents. This method unfortunately reduces the sensitivity of the relay in ordinary operation, and, in any case, the fault current settings have to be sufficiently high to prevent operation on the fraction of high-frequency current which may pass through the relay itself.

(4) High fault current settings required, due to impedance of current transformers and pilot wires.—

It must be remembered that *all* the power available for relay operation has to pass through the current transformers and the pilot wires, and the impedance of these necessarily implies a comparatively high fault-current setting. The use of special super-sensitive relays largely overcomes this difficulty, but relays operating on only 0.02 VA cannot be either so robust or so reliable as a relay of more common design operating on 2 VA or more.

It is therefore seen that in practice Merz-Price protection, though perfectly satisfactory up to a point, does suffer from certain serious defects. These defects, though they can be minimised in the various ways indicated above, must always be present to a greater or less extent, and the incorrect switching which takes place as a result is a frequent source of worry and anxiety to the engineer.

A system has recently been developed which does not possess in practice any of the disadvantages of Merz-Price protection; it is known as the " Translay " protection system, and a brief description of it may not be out of place.

The relays used in Merz-Price protection are usually of the electro-magnetic type, operating with a plunger or a moving armature. The " Translay " relays are of the induction pattern, and instead of operating almost instantaneously, as is the case with the electro-magnetic type, they have a slight " inverse time " delay. This brief time delay is introduced by magnetic damping, and in practice is an advantage over the instantaneous type, since it gives stability under transient " through fault " conditions which are frequently the cause of incorrect operation by the M-P system. The time delay on a serious fault is only of the order of 0.1 second, and it will therefore be appreciated that under true fault conditions the delay is not disadvantageous, whereas under transient circumstances the added stability is an enormous advantage.

Fig. 2 illustrates the principles of operation of a " Translay " relay in the case of a single-phase feeder. The trip contacts and associated circuits have been omitted to simplify the diagram. It will be seen that the secondary windings of the current transformers are connected to a primary winding in the relay. Coupled with the relay primary is a secondary coil, and it is the induced e.m.f. in this secondary coil that supplies the current for circulation through the pilot wires and operating coils of the relays. The secondary coils of the relays at either end of the feeder are connected in opposition, and under normal conditions no current will flow through the pilot wires. Under fault conditions, however, the balance will be disturbed and a current will flow through the operating coils. The magnetic flux thus produced will react with the leakage flux from the top element and cause rotation of the disk, thus closing the trip contacts.

Since the relay itself acts as a transformer, it is unnecessary to use specially balanced current transformers, as the balancing can be done in the relay. Indeed, this is actually done in practice, and it is therefore possible to use ordinary current transformers instead of the very carefully balanced ones required with other types of balanced protective gear.

It will be observed that the leakage flux from the top electro-magnet leads the flux from the operating coil by nearly 90 deg., and it is this phase difference which causes rotation of the disk.

One of the most serious disadvantages of the Merz-Price system is the frequent operation on transient charging currents in the pilot cables, but in the " Translay " system incorrect tripping due to this cause does not occur. It will be appreciated that charging currents in the pilot cables lead the pilot voltage by nearly 90 deg., and the current through the operating coils of the relays is therefore approximately in phase with the leakage from the electro-magnet. No rotation of the disk will therefore occur. In actual practice a compensating loop is fitted to the electro-magnet to adjust the phase of the leakage flux, in order to insure that the two fluxes shall be as nearly as possible in phase when capacity currents are flowing in the pilot wires.

It is therefore possible to dispense with the use of specially sheathed pilot cables, and further, owing to the saturation of the magnetic circuit, it is not even necessary to use pilot cables insulated for a high voltage, since the maximum potential difference which can exist, even under heavy through fault conditions, is only of the order of 100 volts.

Incorrect operation of the relay, due to transient charging currents in the main feeders, is prevented by the provision of a non-inductive shunt connected across the highly inductive electro-magnet. As was explained above, these charging currents have a high frequency and will take the non-inductive path rather than the path through the relay coils. The objection to the use of a shunt, that it seriously increases the fault-current setting of the relay and thus reduces its sensitivity, does not apply to the " Translay " relay, since fault-current settings very considerably lower than full-load current in the current transformer can be obtained. It must be remembered that, unlike the electro-magnetic type of relay, the whole of the power for operation of the relay does not have to pass through the pilot wires, since the torque for operation is dependent on the interaction of the local flux with the flux due to the current in the pilot wires. A high torque is therefore obtainable with but a small current in the pilot wires. This current is only of the order of 25 milliamperes, and the pilot cables can therefore be of high resistance.

In conclusion, it must be said that these notes, and particularly the description of the " Translay " system, are necessarily somewhat abbreviated, but they have been written to focus attention on what is still one of the greatest problems in e.h.p. transmission. Experience has shown that the Merz-Price system, while perfectly satisfactory up to a point, does not include perfect stability among its characteristics. The " Translay " system is an important advance, and it has proved itself to be thoroughly reliable for difficult conditions under which other systems have failed.

Delray Power Station, Detroit, U.S.A.

The first portion of the Delray power station of the Detroit Edison Co., which has been designed for an ultimate capacity of about 350,000 kW, was put into operation last August. Steam conditions at the boiler stop valves are :—Pressure, 455 lb. per sq. in.; temperature, 700 deg. F. Five 340,000-lb. boilers are now installed. A separately fired super-heater will be added in connection with the 10,000-kW B.T.H. high-temperature turbine to be installed later. Other features include the use of Underfeed stokers, water-cooled walls, and air pre-heating. The two 50,000-kW, 1,200-r.p.m. turbo-alternators are bled from four of the 21 stages. The exhaust is condensed in single-pass condensers with 60,000 sq. ft. of surface. Generation voltage is 12,200, stepped up to 24,000 by individual auto-transformers. The 250-volt exciters are directly-coupled. Supply for auxiliaries is obtained from two 4,000-kW Laval compound condensing 250-volt d.c. turbo-generators (turbines 3,000 and 4,000 r.p.m., generators 360 r.p.m.), from which steam is extracted at the fourth stage for heating the building.

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Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

The "Review" at Christmastime.

As stated in an announcement appearing in our advertisement pages to-day, certain alterations will be necessary in arrangements for the publication of the ELECTRICAL REVIEW for December 20th and 27th, owing to the Christmas holidays falling in the middle of the week. Advertisement copy and blocks for displayed announcements for our December 20th issue will require to be in our hands by next Wednesday (December 11th) at the latest, and small classified advertisements on Monday, December 16th. For the December 27th issue the corresponding dates for the receipt of advertising copy are December 16th and 23rd, respectively.

Editorial matter for the December 20th issue must be in our hands one day in advance of the usual time.

New Municipal Showrooms.

The Dumfries-shire County Council, in connection with its electricity undertakings, has opened an office and showroom at Central Avenue, Gretna, Dumfriesshire, and asks for publicity matter relating to electricity supply. The engineer and manager is Mr. C. R. Westlake.

The Morecambe Electricity Committee proposes to transfer the showrooms of the Electricity Department from the power station to Queen Street, one of the chief shopping streets of the town. The proposal has met with opposition, because the Committee recently spent £500 on the existing showroom, and the local electrical contractors are objecting on the ground that the prospective development promises an extension of municipal trading.

A Proposed Trading Register.

Reporting on the proposal for the compilation of a register for the electrical industry, containing the names of those entitled to trade terms, the Trading Committee of the Electrical Contractors' Association says that it has every reason to believe that several branches are actively pursuing the object put forward. Certain manufacturing associations are supporting the principle involved, and so far the Trading Committee has heard of no serious opposition to the scheme. It is also interesting to note that at a joint meeting with the Electrical Wholesalers' Federation recently, a resolution was submitted supporting the Register and agreeing to bear *pro rata* a portion of the cost.

The Position in America.

The New York correspondent of *The Times* says that unfortunate exaggeration of the United States President's efforts to avert a psychological decline in business has served only to advertise the decline which was in progress well before stocks collapsed, and as a result trade and manufacturing statistics are being much more closely studied than for some time past. These figures are not altogether re-assuring for those who hope for an early ending of the business reaction. Steel production, for example, has now dwindled to 68 per cent. of capacity against a normal 80 per cent. at this time of year. In the Pittsburgh district it is down to 65, and in small independent mills in the Cleveland district, which depend largely on orders from the automobile industry, it is only 35 per cent. Production of pig iron has likewise declined markedly, in spite of increased orders for iron and steel from railways and engineering enterprises, and so has the production of cotton textiles, boots, shoes, leather, and, of course, automobiles. Building operations continue their decline, and steadily falling rents in widely separated parts of the country make it seem likely that it will be some time before building will again expand, notwithstanding considerably cheaper money. Shares of copper companies were unsettled last week because of intimations that the price of the metal was likely to be reduced below 18 c., but strong export buying seemed to make that fear premature. Our contemporary also records declines in wholesale commodity prices, railway freight traffic, cereal exports and brokers' and bankers' loans.

Swiss Electrical Machinery Exports.

The exports of electrical machinery from Switzerland during the first half of the current year attained a value of £1,103,280.

The E.C.A. and the "Outlet" Campaign.

Upon the recommendation of its Finance Committee, the Electrical Contractors' Association has decided to make a grant of £500 towards the expenses of the E.D.A. Electric Homes (Outlet) Campaign, in addition to its usual contributions to E.D.A. funds.

The British Industries Fair.

Mr. E. J. Jennings, hon. secretary of the Electrical Advisory Committee of the Birmingham Section of the B.I.F., informs us that the British Electrical Development Association will occupy a central position in the Electrical Section of the 1930 Fair, and an attractive kiosk is being erected, the colouring of which will be buff, red and gold. The Committee considers it very desirable that the distinctive colours of the E.D.A. kiosk should be adopted for the various stands in the Electrical Section, and that all the exhibitors should adopt these colours. The Fair management has, therefore, made arrangements with the official contractors for red and buff to replace, where possible, and at no extra cost to the exhibitor, the usual black and white.

On Tuesday last Mr. G. M. Gillett, Secretary to the Department of Overseas Trade, announced at a luncheon organised by the Birmingham Chamber of Commerce that he was appointing a committee to examine the present situation of the Fair, and to consider means for extending its utility to British trade. This would be the first inquiry of the kind since the Warner Committee in 1921, and there were now new circumstances to consider. Lord Chelmsford would be the chairman of the new committee, and until a report was received he would ask the Government to continue its grant of £25,000 for publicity purposes.

E.D.A. Sales Conference.

A paper on "Showroom Organisation and Salesmanship in the Electrical Industry," was given by Mr. A. C. Bostel at the South Wales Institute of Engineers, Cardiff, on November 12th. Mr. Bostel said that the electrical showroom must be considered to be the best medium to convey the electrical message to the people, and the centre from which propaganda should radiate. He outlined the manner in which showroom windows and interiors should be arranged, the service expected of the showroom staff, and the qualifications which go to make a successful salesman and sales organisation.

Swedish Plant for Russia.

The Russian Commercial Delegation at Stockholm has concluded an agreement with Karlstads Mekaniska Verkstads Aktiebolag for three turbines of the Kaplan type, each of about 35,000 h.p., for the new Russian hydro-electric power station on the river Svir. A fourth turbine of the same size will be constructed according to Swedish designs at the Leningrad works of the Soviet Mechanical Trust. The same Swedish works has previously delivered eight turbines of 11,000 h.p. each for the Russian hydro-electric power station Volkhovstroy, which has been working with very good results for some years. The value of the new order, which was obtained in keen competition with German and Swiss works, is Kr. 3,700,000. The hydro-technical planning of the new Russian power station was carried out by Swedish engineers belonging to the Vattenbyggnadsbyraan (Hydraulic Construction Bureau) at Stockholm.—*Reuter's Trade Service* (Stockholm).

American Optimism and British Pessimism.

In its weekly letter dated November 29th, the Federation of British Industries states that in spite of the financial shock which the United States has recently sustained, the news coming from that country is persistently optimistic. There is a determination to cut losses and to undertake a big "prosperity offensive." The F.B.I. contrasts this with our own pessimistic propensities. We bemoan the fact that we are losing ground in export markets, and dolefully point to the large number of unemployed, although we are emerging with a very reasonable show of success from a long and bitter struggle with trade depression. British manufacturers and traders are urged to make more of their successes, for there is a tendency among overseas customers to accept both ourselves and the United States at our own respective valuations.

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The Aldershot Company's Hindhead Showroom.

About a year ago the Aldershot Gas, Water and District Lighting Co. took over the Hindhead and District Electric Light Co., and has since been engaged in improving and extending the facilities for the supply of electricity. The opening of a new electricity showroom on November 19th, forms the company's latest development. The ground floor of the building is devoted to the display of lighting fittings and domestic appliances, whilst the premises above are used as

The New Showroom at Hindhead.

a residence by the company's chief accountant. The accompanying illustration shows the attractive arrangement of the interior of the showroom.

Proposed New Electrical Factory.

It is reported that Messrs. ALLEN WEST & Co., LTD., Brighton, are negotiating for the purchase of the Government rolling mills at Woolston, Southampton, which were built at great cost during the war and were completed just prior to the Armistice. The property has a total area of about 82 acres. The company proposes to adapt the mills to the production of heavy electrical equipment, and this side of its business would be transferred to the new works.

Unemployment.

The number of persons on the registers of Employment Exchanges in Great Britain showed an increase of 14,366 during the week ended November 18th. At that date the total was 1,273,500, as compared with 1,259,134 on November 11th, and 1,364,423 on November 19th, 1928.

Japanese Electrical Exports.

Official statistics show that during the first eight months of the current year, Japan exported electric lamps to the value of 3,878,351 yen, as compared with 2,932,062 yen for the whole of 1928. The value of insulated wire exports was 2,399,392 yen (against 1,880,747 yen in 1928); exported electrical machinery was valued at 1,657,016 yen (against 1,104,962 yen); and telephone apparatus at 686,825 yen (against 329,168 yen). The yen is equivalent to about 2s.

North-Western D.J.I.C. Meeting.

The annual conference of authorised undertakers in the North-Western Area, for the purpose of electing employers' representatives on the District Council and District Joint Board, took place on November 26th at the Town Hall, Manchester. The secretary (Mr. A. H. Banks) explained the unavoidable absence of the chairman, Alderman T. E. Higham, this being the first occasion since the creation of the Council (ten years ago) upon which the chairman had been absent. Alderman W. Walker, who presided, dealt with the salient points in the annual reports of the Council and Board during the past year, and the reports were unanimously approved. Three vacancies had arisen in the group of the largest undertakers owing to the retiring representatives having ceased to be members of the councils of the constituent undertakers, and new representatives were appointed by that group. The remainder of the retiring representatives were re-elected. The same members were elected to the District Board with two exceptions.

Australian Tariff Increases.

A number of increases in Australian import duties took effect on November 22nd. Among the classes of goods affected are boilers, wireless receiving sets and headphones.

Turkish Tariff Alterations.

The *Board of Trade Journal* gives a list of alterations in Turkish import duties which will come into operation on April 26th next. It includes dynamos and accumulators, the new rate on which will be 1,900 piastres per 100 kg.; Diesel engines, 300 pts. per 100 kg.; meters and measuring instruments for gas, electricity and water, 3,750 pts. per 100 kg.; and instruments and apparatus for telegraphs and telephones and parts thereof (not including wire), 4,500 pts. per 100 kg.

The Contractors' Dinner.

The annual dinner of the E.C.A: Allied Associations is to be held at the Savoy Hotel on January 22nd, 1930.

Recent Contracts.

THE ALTON BATTERY CO., LTD., has received an order for three batteries for the Shanghai automatic telephone network.

The Auckland Transport Board has placed an order worth £15,000 with the BRITISH GENERAL ELECTRIC COMPANY for 104 "Witton" tramway motors and accessories.—*Reuter* (Wellington, N.Z.).

Messrs. JOHN BROWN & Co., LTD., Sheffield, have received an order for eight hollow-forged steel drums in connection with Puerto Nueva power station and the Cia. Itale-Argentina de Electricidad, Buenos Aires.

New Swedish Cable Factory.

The Allmänna Svenska Elektriska A.B. is establishing a new cable factory in the vicinity of Stockholm, which is to take over the work of the Liljeholm cable works. The latter is said to have been controlled by the A.S.E.A. for some time past.

Swedish Enterprise in South America.

It is stated that the Compania Argentina de Telefonos del Litoral has now become associated with the L.M. Ericsson Company. The seat of the former is in Concordia in the province of Entre Rios, and it owns concessions in the provinces of Corrientes and Missiones, as well as in the Republic of Paraguay.

"Electricity for the Home"—Correction.

Owing to a printer's error, the first line of the third paragraph in the article on Tunbridge Wells ("Electricity for the Home," p. 947), in our last issue, was dropped and another line was put in its place. The correct opening of the paragraph is:—"The rates of charge for energy fall into two scales—one for the town and Southborough, the other for outside areas." A correction was made in the last few thousand copies printed.

A Christchurch (N.Z.) Electrical Exhibit.

We are indebted to the British Electrical Development Association for a photograph (reproduced herewith) of an exhibit arranged by the Christchurch (N.Z.) Municipal Electricity Department at the Christchurch Winter Show held in August last. Mr. E. Hitchcock, general manager of the De-

An Electrical Exhibit at Christchurch (N.Z.).

partment, tells E.D.A. that an attendance of 80,000 was recorded, exclusive of school children, of whom many thousands were admitted free of charge. The Department's stand was a centre of interest, and in addition to practically continuous cooking demonstrations, there were demonstrations of water-heating and other apparatus. A large number of inquiries resulted, many of which have already resulted in sales.

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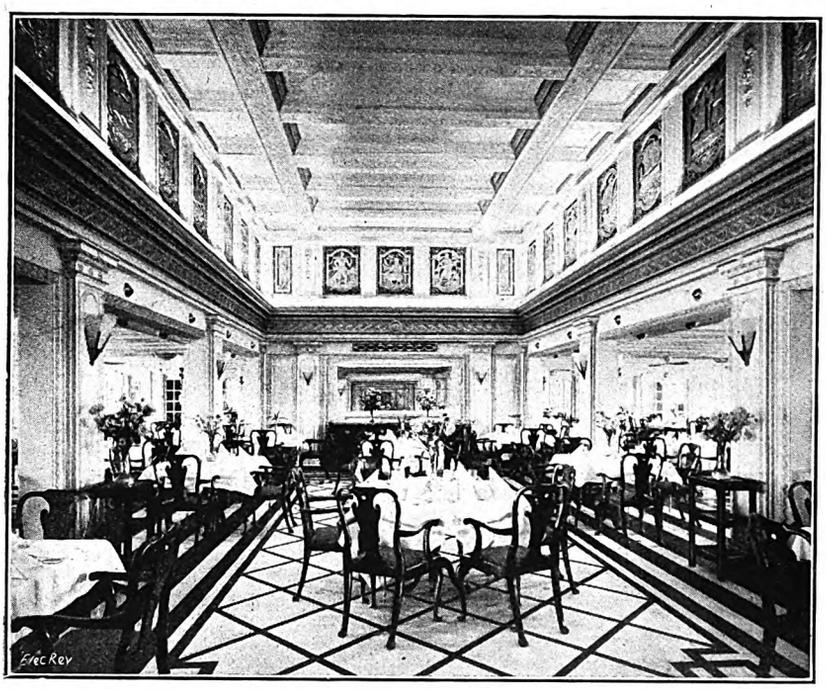
Estonian Foreign Electrical Trade.

The *Board of Trade Journal* shows that the imports of "electric machines, apparatus and implements" into Estonia during September, had a value of 320,700 kr. (£17,600), while exports of the same class were valued at 20,400 kr. (£1,100).

The T.S.S. "Orontes."

The twin-screw steamer *Orontes*, which has been constructed on palatial lines, contains many special electric lighting fittings designed and manufactured by Metro-Vick Supplies to the requirements of Mr. A. N. Prentice, architect to the Orient Co.



A Dining Saloon on the T.S.S. "Orontes."

The accompanying illustration shows the luxurious lay-out of one of the dining saloons, which, in addition to concealed ceiling lighting, includes a number of panelled wall-fittings.

New Catalogues and Lists.

Metro-Vick Supplies, Metro-Vick House, 155, Charing Cross Road, W.C.2.—A price list (Folder No. 4102/6) of Cosmos lamps.

Cryselco, Ltd., Kempston Works, Bedford.—A showcard, illustrating in colour a Christmas tree decorated with Cryselco lamps.

Marconiphone Co., Ltd., 210-212, Tottenham Court Road, W.1.—A well-produced and illustrated catalogue of the company's radio receivers, loud-speakers and accessories. Priced.

Automatic Telephone Manufacturing Co., Ltd., Strowger Works, Liverpool.—An illustrated pamphlet drawing attention to Strowger private automatic telephone exchanges.

Cambridge Instrument Co., Ltd., 45, Grosvenor Place, S.W.1.—A card drawing attention to Cambridge recording and indicating thermometers.

Brookhirst Switchgear, Ltd., Chester.—Leaflet No. 301, referring to the Dutch motor liner *Johan van Oldenbarnevelt*, and particularly to Brookhirst control gear used for the motor-driven auxiliaries.

Marconi's Wireless Telegraph Co., Ltd., Marconi House, Strand, W.C.2.—Publications Nos. 1070/3, 1108, and 1109, dealing, respectively, with the 250-W fixed wave-length telephone set, the 20-50 W portable station, type Y.A.4, and the short-wave transmitter, type T.N.7.

Siemens Electric Lamps & Supplies, Ltd., 38-39, Upper Thames Street, E.C.4.—A current general price list of electrical accessories. [In our last issue we referred to this company's "Xcel" showcard, entitled "Modern Magic," but incorrectly ascribed the publication to Siemens Bros. & Co., Ltd.]

Revo Electric Co., Ltd., Britannia Works, Tividale, Tipton.—Three leaflets containing illustrated particulars of "Revo" loud-speakers, switch and fuse gear, and cast-iron explosion-proof fittings.

Messrs. E. J. Wilcock, Ltd., 30 and 32, Cowper Street, Summer Lane, Birmingham.—A leaflet drawing attention to the company's service for electric motor and dynamo repairs.

Bastian Meter Co., Ltd., Farnham Road, Trading Estate, Slough.—Two pamphlets dealing with "Mascarini" boilers, "Baby Imp" and "Super Imp" fires, "Imperator" radiators and tubular heaters. Illustrated and priced.

Messrs. T. Harding Churton & Co., Ltd., Atlas Works, Water Lane, Leeds.—Circular No. 708 giving a description and specification of single-, two, and three-phase induction motors.

Messrs. S. G. Brown, Ltd., Western Avenue, North Acton, W.3.—The November issue of "The Brown Budget" in addition to articles on the company's activities, contains an interesting article on window displays.

Electric Construction Co., Ltd., Bushbury Engineering Works, Wolverhampton.—A well produced and illustrated brochure describing the construction of E.C.C. rotary convertors.

The Industrial Co-partnership Association.

Mr. W. A. Appleton, joint president, presided at the annual meeting of the Industrial Co-partnership Association on November 27th. The report presented drew attention to the steady improvement which had taken place in industrial relations. Mr. F. W. Raffety, hon. treasurer, referred to the scope at the present juncture for a big expansion in the work of the Association, which recognised that a larger measure of publicity and general propaganda must be undertaken at once. He appealed to the general public for largely increased support. It was announced that Mr. Emile Garcke, chairman of the Brush Electrical Engineering Co., Ltd., had become chairman of the executive. The joint presidents—Viscount Cecil and Mr. W. A. Appleton—were unanimously re-elected, as were also the honorary treasurer, Mr. F. W. Raffety, and the joint hon. secretaries, Mr. C. Plaistowe and Mr. F. K. Ogden.

Chesterfield Contractors' Dinner.

Compulsory registration was the principal theme of the speeches at the second annual dinner of the Chesterfield Sub-Branch of the Electrical Contractors' Association held on November 27th. The Mayor, Councillor H. J. Watson, was amongst the guests. Mr. E. R. Morris (chairman), pleading for adequate protection, thought that the only effective way of dealing with the position was for every contractor to be registered in the same way as doctors, lawyers, chemists and dentists were registered. If there was compulsory registration, any installation engineer who was found to have performed "jerry" or unsafe work could be hauled before his registration authority, and be called upon to show cause why his name should not be struck off the register. Mr. T. Beardsall, chairman of the Northern Section, said that the various Government Departments and similar authorities who had to do with electrical installation work were fully alive to the position, and were considering ways and means to amend matters. Mr. L. C. Penwill (General Secretary of the E.C.A.) pointed out the difficulties attending compulsory registration. To his mind it would also involve the compulsory registration of operatives as well as of firms and individual employers. Mr. I. Scott Mackenzie, electrical engineer, Staveley Coal and Iron Co., Ltd., also spoke. The dinner was followed by a dance.

The E.D.A. Outlet Campaign.

An attractive booklet (E.D.A. 800) has been produced by the British Electrical Development Association in connection with the Electric Homes (Outlet) Campaign. It bears the title "The House you Want," and the first half deals very thoroughly with the many things which electricity can "do about the house." Typical appliances are illustrated, and the reader is told what each will do on a consumption of a unit of electricity. The necessity for a sufficiency of plug points is, of course, particularly stressed. The second half goes over the house room by room, from the hall to the garage. Each room is the subject of an illustration, in which the appropriate electrical appliances are shown, and in each picture "outlets" are placed in suitable and convenient positions, being marked by red circles. The booklets are available at £4 per thousand (*i.e.*, less than penny each), with discounts for large quantities. The name and address of an undertaking, company or individual can be placed on the back cover at the printers' net cost. The booklet is certainly worth the price, and should prove of considerable service.

Russian Electrical Imports.

During the fiscal year 1927-1928 the importation of electro-technical products into the Soviet Republic was largely in excess of that of the previous year and was, in fact, easily a record. The large increase is partly explained by the big development in the electrification and the industrialisation of the country and partly by the utilisation of the German credit of 30,000,000 marks. The figures for all electro-technical imports for the two years are as follows:—

	Tons.	Value in roubles.
1926-27	13,971	24,815,000
1927-28	26,465	46,594,000

The average value per ton was thus about 1,770 roubles. This increased importation has taken place at the same time as the local production of electro-technical goods has increased considerably. While the proportion of the imports to the total sales was 23.2 per cent. in 1926-27, it was 29.7 per cent. in

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1927-28. As compared with the preceding year, Sweden's share of the business rose from 9.4 to 15.6 per cent., and that of the United States from 5.6 to 8.6 per cent. The first-named country mainly supplied transformers, while the United States supplied mostly precision machinery and sundries. Germany's share of the trade fell from 65.5 to 54.5 per cent., and Great Britain's from 10.1 to 5.7 per cent. In surveying the existing situation, it is clear that, notwithstanding the rapid headway that the electro-technical industry is making in Russia, that country will continue to require increasing quantities of foreign products. It is stated that the Soviet Republic absorbed 16 per cent. of the total exports of this class of goods from all European countries during 1927-1928.

Social Events.

The annual dance of the staff and employés of the Mullard Wireless Service Co., Ltd., was held last Friday at the New Royal Horticultural Hall, Westminster. In spite of the somewhat inclement weather, there was an excellent attendance, some 2,000 of the Mullard staff and their friends being present. During the interval cups and trophies were presented by Mrs. Mullard to winners of various sporting events during the past year. A presentation was made by the staff to Mr. S. R. Mullard during the evening.

The staff of the Andover branch of the Western Electricity Supply Co., Ltd., held a dance at the Guildhall, Andover, on November 29th. Over 200 people attended, and the event was so successful that it is hoped to make it an annual function.

Electricity at the Smoke Abatement Exhibition.

In our review of the recent Smoke Abatement Exhibition at Manchester, we made mention of the electrical stand arranged

Two Views of the Electrical Stand at the Manchester Smoke Abatement Exhibition.

by a number of neighbouring electricity supply undertakings, with the assistance of the British Electrical Development Association, the Electrical Contractors' Association and a number of leading electrical manufacturers. We have now received from E.D.A. some views of this stand and reproduce two of them herewith. The first imparts an idea of the general aspect of the stand and shows the novel lighting arrangements. The panels flanking the main entrance bear the names of the undertakings responsible for the display. A section of the stand appears in the second illustration. In this compartment a group of typical domestic appliances was arranged. Each appliance was connected by a ribbon to a little poster bearing the words "What a unit of electricity will do," and each was provided with a card stating the number of hours for which a unit of electricity would keep the appliance running. In the centre of the stand was a suite of seven rooms, each equipped with appropriate appliances and wired in accordance with the E.D.A. Specification, while other parts of the stand were devoted to specialised displays of apparatus. Cooking demonstrations (including confectionery and bread making) were given daily.

Bankruptcy Proceedings.

E. J. G. HURLES, wireless dealer, 8, Blackfriars Road, S.E., and 119, Cambridge Road, Teddington.—An application for an order of discharge was made on November 29th to Mr. Registrar Mellor at the London Bankruptcy Court, on behalf of this bankrupt who failed in August, 1928. The Official Receiver reported that the provable debts amounted to £1,883 and there were no assets. The bankrupt attributed his insolvency to lack of work and capital, keen competition and price-cutting by traders, to insufficiency of gross profits to meet overhead charges and to bad debts. The application was opposed by the Official Receiver on the following grounds:—Insufficiency of assets to equal 10s. in the £ on the amount of the liabilities; omission to keep proper books of account; trading with knowledge of insolvency; misdemeanour under the Bankruptcy Act; misconduct in that having contracted to purchase for cash goods for sale at minimum prices, the bankrupt had obtained under the pretence of dealing as a trader in accordance with the terms of his contract, and by means of worthless cheques, goods for which he had not paid and had disposed of them at cost price, and otherwise at less than the stated minimum price. Mr. Clifton Hilbery, on behalf of the bankrupt, submitted that the terms upon which his client was re-admitted to the valve manufacturers' "ring" were too onerous, and the bankrupt thought to comply with the terms regarding sales by selling at a ridiculously low rate. He pointed out with regard to a police court charge which had been mentioned, that the bankrupt, acting under advice, pleaded guilty to a technical offence, and when the facts were subsequently before the Court the sentence was remitted to a fine of £15. It was not the desire of the Court to punish a man a second time for an offence, as would be the case if the charge of not keeping proper books were now to be taken into account. He asked the Court to grant a discharge subject to judgment for £25.

The Registrar said the circumstances were not such that he could make a money order, and he suspended the discharge for two years.

L. W. WESTBURY, 383, Birmingham Road, Walsall, Staffs, lately trading as L. W. Westbury & Co. and Walsall Radio Co., 146, Lichfield Street, Walsall, Staffs, wireless goods dealer.—The receiving order in this matter was made on November 1st on the debtor's own petition. The first meeting of creditors was held on November 20th at the Official Receiver's office, 30, Lichfield Street, Wolverhampton, when the case, being a summary one, remained in the hands of the Official Receiver as trustee. The following are creditors:—

	£		£
Cattell, W.	100	Cossor & Co., Ltd. ...	30
Steel, B. A.	100	Green & Jackson ...	23
Siemens Bros. & Co., Ltd.	105	Griffin, J. W., Ltd. ...	57
Brownie Wireless Co. ...	24	Mullard Wireless Service Co., Ltd.	38
Pettigrew & Merriman...	80	Toubkin, J.	82
Ripaults, Ltd.	99	Wilding-Cole, Ltd. ...	67
Burton, C. F., & H. ...	23	Brown, S. G., Ltd. ...	38
Benjamin Electric, Ltd.	26	Turner & Co.	37

H. B. CLARKE, 2, Devonshire Road, Carrington, Nottingham, electrical engineer.—This debtor's application for discharge was heard on November 21st, at the County Court House, Nottingham. The receiving order was made in May of this year, and debtor's statement of affairs showed liabilities of £1,751, against assets that had realised £73. A dividend was to be paid of a little over 3½d. in the £. The discharge was suspended until such time as a dividend of 10s. in the £ was paid.

H. GASCOIGNE, wireless dealer, &c., 40, Cricklade Street, Cirencester, Gloucester.—First meeting, December 3rd, at the Official Receiver's office, 38, Regent Circus, Swindon; public examination December 18th, County Court Buildings, Swindon.

A. K. E. STRATHDEE (Emsco Radio), electrical engineer, 923, Romford Road, Manor Park.—Bankrupt's discharge suspended until January 29th, 1930.

W. T. GARNETT (W. T. Garnett's Cable Co.), electric cable and wire manufacturer, Barkerend Mills, Bradford.—Last day

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for proofs for dividend, December 10th. Trustee, Mr. J. O. Morris, Official Receiver, 12, Duke Street, Bradford.

R. C. Hudson, electrical contractor, &c., 1 and 2, Bridge Road, Chatburn, Lancaster.—Receiving order made November 25th on debtor's own petition. First meeting to-day (Friday) at the Official Receiver's office, District Bank Chambers, Blackburn; public examination, January 15th, at the County Court House, Blackburn.

A. North and F. North (A. & F. North), wireless and electrical engineers, 38, Bradford Road and Market Place, Dewsbury.—Trustee, Mr. F. Gomersall, 16, Bond Street, Dewsbury, released August 12th.

E. E. Peace (Peace & Co.), manufacturing electrical engineer, 230, High Street, Erdington, Birmingham.—First meeting held December 4th, at the Official Receiver's office, 191, Corporation Street, Birmingham; public examination, January 8th, at the Court House, Birmingham.

H. C. Sharpe, wireless engineer, late of 42, Molesworth Street, Wadebridge.—Trustee, Mr. T. Barton, Official Receiver, City Chambers, Catherine Street, Salisbury, released November 15th.

Company Liquidations.

G. Haslam & Co., Ltd., electrical engineers, The Broadway, Leigh-on-Sea.—The statutory meeting of creditors was held recently, when Mr. H. J. B. Feist, the liquidator, reported that the liabilities were £801, of which £501 was due to the trade, and £300 to the bank, and there was a deficiency of £248, so far as the creditors were concerned. The liabilities might be slightly increased, whilst book debts might not produce the figure at which they were set down. The business was established in 1918, and was carried on successfully as a private concern until September, 1922. The company was then formed with a nominal capital of £2,000, of which £1,712 had been issued and was fully paid. During the first year or two the company was successful. A lock-up shop was acquired at London Road, Leigh, but the trade there had not been good, losses aggregating some £700 to £800 having been incurred. It had therefore been closed down, and the stock was removed to the Broadway premises. The creditors decided to confirm the voluntary liquidation of the company with Mr. W. A. J. Osborne (Messrs. Corfield & Cripwell), Balfour House, Finsbury Pavement, E.C., as joint liquidator.

Fellows Manufacturing Co., Ltd.—A petition has been presented to the High Court for the winding up of the above-named company by Messrs. Lawrance Messer & Co., 14, Old Jewry Chambers, E.C., creditors, and will be heard in London on December 9th.

Radio Maintenance, Ltd.—A meeting of members is called for December 27th at 15-17, King Street, St. James's, S.W., to hear an account of the winding up from the Liquidator, Mr. J. J. Middleton.

Ideal Wireless Co., Ltd.—A petition for the winding up of this company has been presented to the High Court by A. Rist (1927), Ltd., 133, Moorgate, E.C., and will be heard in London on December 9th.

Dissolutions of Partnership.

Tower Radio Supplies, wireless dealers, 5, High Street, Shoreditch, E.—Mr. M. Davis and Mr. A. Bowman have dissolved partnership. Mr. Bowman will attend to debts.

Barton & Co., wireless dealers, &c., 4, West Crescent, St. Annes-on-Sea.—Mr. C. T. Barton and Mr. L. W. Horner have dissolved partnership.

Book Notices.

"General Physics and its Application to Industry and Everyday Life," by E. S. Ferry. Pp. xix+839; figs. 603. London: Chapman & Hall, Ltd. Price 20s. net.

"Elements of Electrical Engineering," by A. L. Cook. Pp. x+584; figs. 365. London: Chapman & Hall, Ltd. Price 20s. net.

"A Text Book of Illumination," by W. Kunerth. Pp. x+269; figs. 120. London: Chapman & Hall, Ltd. Price 15s. net.

Miscellaneous Publication of the U.S.A. Bureau of Standards. No 95. "Protection of Electrical Circuits and Equipment against Lightning" (25 cents).

"Science Abstracts A and B." Vol. XXXII. Part II. November 25th, 1929. London: E. & F. N. Spon, Ltd. Price 3s. each net.

New Indian Companies.

Among the electricity supply concerns recently formed in India are the Dharwar Electric Supply Co., 64, Shekh Memon Street, Bombay, capital 400,000 rupees; the Upper Jumna Valley Electricity Supply Co., 1,000,000 rupees; and the Upper Ganges Valley Electricity Supply Co., 1,000,000 rupees, the address of the last two companies being 6-7, Clive Street, Calcutta.

Trade Announcements.

The London office of Messrs. A. C. Wells & Co., Ltd., is now at 4, Bradley's Buildings, White Lion Street, Islington, N.1.

Mr. E. Inger, electric light and power engineer, has commenced business at 1, Bank Chambers, Roushill, Shrewsbury. He has a branch concern at 50, Watling Street, Church Stretton.

Messrs. Mosses & Mitchell, Ltd., have taken more commodious premises at Chiswell Works, 60, 62 & 64, Ironmonger Row, E.C.1.

On account of the greatly increasing demand for electric resistance furnaces for industrial purposes, and the wide range of trades for which they are required, the Electric Furnace Co., Ltd., 17, Victoria Street, S.W.1, has formed, and will be the sole proprietor of, a subsidiary company, the Electric Resistance Furnace Co., Ltd., to deal with this branch of its business.

Messrs. M. W. Woods, Ltd., Colchester, inform us that the association of interests between themselves and Messrs. S. G. Leach & Co., Ltd., has been terminated. They have, therefore, again opened an office in London situated at Kingsway Chambers, 46, Kingsway, W.C.2 (telephone: Holborn 4736), in charge of Mr. M. G. Woods.

English Turbo-Generators for Holland.

A large new station is to be built near Ijmuiden for the Provinciaal Electrisch Netbedrijf. After having examined the tenders for the supply of two turbo-generators, a committee of the Provincial States is said to have decided in favour of the acceptance of the lowest offer, which was submitted by Messrs. C. A. Parsons & Co., Ltd., at 1,233,000 fl. This decision has been reached despite the urgent representations of the Minister for Home Affairs and the secretary of the State Commission for Labour Relief that if possible the order should be placed with a Dutch firm. However, the committee came to the conclusion that the question of the reliability of the turbines rendered it desirable for the contract to be allocated to the English company. It appears that an order has also been placed outside Holland for the supply of cables

For Sale.

Nelson Corporation Electricity Department has for sale a number of second-hand d.c. motors, 230 V and 460 V, from ½ h.p. to 20 h.p. (See our advertisement pages to-day.)

Prices of Raw Materials.

Messrs. F. Smith & Co. and Messrs. James & Shakespeare report, December 3rd: No change in copper prices.

Messrs. James & Shakespeare report, December 3rd: English pig lead, £22 10s., 5s. dec.

Messrs. Edward Till & Co. report, December 3rd: No change in the price of India-rubber, Para fine.

In their letter dated November 30th, Messrs. James Forster and Co. state that after the previous week's declines, the lead market was comparatively steady last week. The market in the United States was also quiet. Consumers' demands in this country remains quiet, their immediate requirements having been satisfied on the drop in values last week. Producers, meanwhile, are maintaining their price without effecting sales of any importance. No revival in demand has been seen from Germany, where trade conditions are reported to be far from satisfactory. Producers may be able to maintain prices for the time being, but in the long run circumstances over which they have no control, may force them to lower their price to a level more in keeping with the position of supply and demand.

Lighting and Power Notes.

Argentina.—Buenos Aires.—A large super-power station has recently been completed in the new port of Buenos Aires by the Compania Hispano-Americano de Electricidad. The buildings and plant, which have taken 34 months to erect and install, cover nearly 17,000 sq. metres, sufficient space being allowed for future extensions producing up to 1,000,000 h.p. The boiler room contains eight boilers and the engine room four turbo-alternators, each of 75,000 h.p. The station is the largest public utility establishment of its kind in Argentina.—*Reuter's Trade Service* (Buenos Aires).

Ashford (Kent).—New Plant.—A new 1,350-h.p. Diesel engine installed at the electricity works was started up recently by Mrs. Wilson, wife of the Urban District Council electrical engineer.

Barking.—Loans Sanctioned.—The Urban District Council Electricity Committee has received sanction to the borrowing of £3,092 for mains, £2,682 for house wiring installations (for hire), and £120 in connection with Becontree sub-station.

Bath.—Revised Electricity Tariff.—The Corporation Electricity Committee recommends the following revised scale of charges for electricity for private residences as from the date of the reading of the meters for the December quarter:—½d. per kWh for any purpose, with standing charge on the ratable value ranging from £2 5s. per annum for up to £14 ratable value to £5 for £40, plus 2s. for every £1 of ratable value over £40.

Birmingham.—Hams Hall Station.—In a report to the City Council, the Electric Supply Committee asks for sanction to a loan of £200,000 to meet the excess expenditure upon the Hams Hall power station.

Electricity Supply Progress.—At a meeting of the Corporation Electricity Supply Committee held last week, states the *Birmingham Post*, the progress report of the department for October was read, showing that 1,026 new consumers' pre-

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mises had been connected during the month, adding nearly 9,000 lamps in the lighting section and 2,200 h.p. in the power section. Arrangements were also approved for a number of additional manufacturing supplies, now in hand. It was also reported that the popularity of the domestic contract tariff continued, well over 7,000 consumers having entered into agreements, and that a recent reduction in the charges for connecting up supplies was having the desired effect.

Bognor.—RURAL SUPPLIES.—The first section of the Bognor Gas & Electricity Co.'s scheme for supplying electricity to its rural areas was completed recently, when the e.h.p. main from Middleton sub-station to Yapton sub-station was connected to its supply system.

Bradford.—LOAN.—The Corporation Electricity Committee is to apply for sanction to the borrowing of £200,000 to cover anticipated expenditure for a period of three years.

Burnley.—ELECTRICITY TARIFF CONCESSION.—A concession to Burnley consumers now debarred from participating in the ratable value system of charging for electricity is recommended by the Corporation Electricity Committee. At present these consumers pay 1d. per kWh. It is suggested that there should be an alternative tariff for heating and domestic appliances of 1d. per kWh for the first 360 kWh and ½d. for each successive kWh.

Canada.—QUEBEC.—The Southern Canada Power Co. is to install power plant in several large branch factories to be erected by British and American companies in eastern Quebec.

MONTREAL.—Consumers of electricity in the City of Montreal and district have now been connected up with an additional source of power derived from a new plant on the Rivière des Prairies (more generally called "The Back River"). The project is unusual in being one of the largest hydro-electric development schemes to be carried out so near to a large city, the power station being not more than seven miles from the financial district of Montreal. The power station will eventually develop 120,000 h.p., for transmission to Montreal, where it will be supplied in bulk to the Montreal Light, Heat, and Power Consolidated for distribution to consumers served by that organisation. The initial installation comprises six units each of 12,000 h.p., only two of which have yet been brought into use, though the other four are likely to be installed before next spring. Power will be stepped up from 12,000 V to 66,000 V, and will be carried by a steel tower transmission line along the south shore into the city of Montreal.

ONTARIO.—In order to satisfy the demand for power in the rural districts, the Ontario Hydro-Electric Power Commission has exceeded its season's programme for the construction of rural transmission lines. The year's programme provides for 1,071 miles, but so far 1,157 miles have been constructed, and work is progressing on 62 miles embraced in the schedule which have yet to be built. A total of 6,700 additional rural consumers will be served by these lines, which will cost approximately £2,650,000.

Continental.—FRANCE.—The Prime Minister last week introduced into Parliament the portion of the National Equipment Bill asking for the immediate vote of £1,600,000 for the development of the electric power industry in France. The scheme aims at making France independent of coal imports by converting more hydraulic power into electricity.

SWEDEN.—The Swedish Vattenfallsstyrelsen (Waterfall Board), which manages the Government-owned hydro-electric stations in Sweden, is asking for a credit of approximately £374,650 in next year's Budget towards the completion of work already started and the enlargement of the Motala and Vasteras power stations. The beginning of constructional work on two new power stations, one at Vargon, to be completed in 1933, and one at Sillre, is also contemplated. In 1928 the Government-owned stations supplied 1,562,000,000 kWh; it is estimated that this year's output will reach 1,700,000,000 kWh.

GERMANY.—Plans have been prepared in respect of a new hydro-electric power station in the Our Valley, near Treves, not far from the Prussian-Luxembourg frontier. The projected installation will have a capacity of 200,000 kW and will necessitate the construction of two large dams.

Coventry.—PLANT EXTENSIONS.—The Corporation Electricity Committee has approved extensions of plant at the Longford generating station, at an estimated cost of £162,000.

MAINS EXTENSIONS.—The Committee is to extend mains at a cost of £4,618.

Crediton.—EXTENSION OF SUPPLY AREA.—The Electricity Committee was instructed at a meeting of the Urban District Council held recently to prepare a report as to the practicability of extending the supply of electricity to Sandford and Newton St. Cyres.

Exeter.—NEW PLANT.—At a meeting of the City Council held last week it was decided that powers be given to the Electricity Committee to apply for sanction to the borrowing of £65,000 for new 7,500-kW plant.

Great Yarmouth.—SPECIAL ORDER.—The Electricity Commissioners have submitted to the Ministry of Transport for confirmation a Special Order made by them authorising the Corporation to supply electricity in part of the rural district of Loddon and Clavering.

Hay.—TRANSFER OF UNDERTAKING.—The Shropshire, Worcestershire, and Staffordshire Electric Power Co. has acquired the electricity undertaking which has been carried on since 1911 by Mr. W. Lilwall. The transfer will take place next March.

Japan.—NEW POWER STATION.—The Nippon Denryoku K.K. is shortly to erect a 35,000-kW power station at Tsurumi to supply electricity to Tokio and the vicinity. The company's 154,000-V transmission line from Ome to Tsurumi is nearing completion, and it has been decided to construct another line from Ome to a place near Tokio, where it is proposed to erect a sub-station of 30,000 or 35,000 kW.

ELECTRICITY SUPPLY PROGRESS.—The Ujigawa Electric Power Co., Ltd., of Osaka, is steadily extending its area of supply. It has now 17 power stations with a total capacity of 111,700 kW in operation and four others aggregating 31,600 kW in course of construction. Government consent to the establishment of nine additional stations, with a combined capacity of 319,180 kW, has been obtained, while application has been made for authority to proceed with the plans for 15 further stations, which will give the company another 36,200 kW.

Kirkham.—INAUGURATION OF SUPPLY.—The Urban District Council's electricity supply scheme was inaugurated on November 28th at Hall Cross, Freckleton, by the Mayor of Preston, Councillor W. Lucas. Coun. E. Hartley (chairman of Kirkham Council) switched on the Kirkham supply, and Mr. R. E. Kent (chairman of Wesham Council) that for the Wesham district. Under the scheme, the supply, which has involved an expenditure of £25,000, is taken from Ribble power station, Preston, to the main sub-station at Hall Cross. There it is reduced from 33,000 V to 6,600 V and transmitted to the distributing centre at Kirkham. There are over 300 consumers.

London.—ST. PANCRAS.—The Borough Council Electricity Committee has obtained sanction to loans of £8,715 for mains and services, £3,831 for meters, £2,214 for consumers' wiring installations (for hire), and £2,580 for domestic apparatus (for hire).

BATTERSEA.—The Borough Council Electricity Committee is to apply for sanction to loans of £78,000 for mains and services, £18,164 for buildings and £3,579 for machinery.

In connection with the South-East England Electricity Scheme the London Power Co., Ltd., has obtained consent to construct a cable tunnel under the River Thames at Battersea to carry cables from the new Battersea power station to the north side of the river.

The Committee has now considered the detailed estimate of the borough surveyor amounting to £29,609, for the erection of the boiler house extension at the generating station, and recommends that the work be carried out.

HAMPSTEAD.—The failure of the electricity supply twice in the course of the last few weeks was the subject of discussion at a meeting of the Borough Council held last week. It was stated that the increased use of electrical energy for lighting, heating, and cooking had caused the existing trunk mains to be considerably overloaded. The nominal capacity of the mains is 13,000 kW, and it is expected that during the Christmas period the load imposed on them will reach 15,000 kW. The Council approved a scheme for providing additional mains at a cost of £47,000.

HORNSEY.—The Corporation Electricity Committee reports that it has received a communication from the London and Home Counties Joint Electricity Authority, offering terms for a permanent arrangement for supplying the Council with electricity. The proposal has been the subject of continuous negotiation with the Joint Electricity Authority since May, and, as it now stands, provides:—(*a*) That the agreement shall continue in force until December 31st, 1950; (*b*) that after the expiration of seven years the Council shall have the option at any time of taking a supply at the "grid price" instead of the price named in the agreement; (*c*) in consideration of an increase in the price already agreed to, the Joint Electricity Authority will repay, in addition to the actual cost of generation at the Council's station, the annual existing loan charges payable by the Council in respect of generation. The committee recommends that this proposal be accepted.

The Electricity Committee is to lay a new feeder to Priory Road sub-station, at a cost of £3,065.

Maidstone.—HOSPITAL SUPPLY.—The Town Council is to give a supply of electricity to the West Kent Hospital on the hospital committee undertaking to pay the capital charges on the actual expenditure for a period of 25 years.

Manchester.—PARLIAMENTARY BILL.—The Corporation has prepared a Parliamentary Bill which seeks powers to enable the Corporation to supply steam for heating and other purposes from any generating station within the city, to repair and maintain consumers' apparatus and fittings and to make by-laws with respect to such apparatus and fittings, and to acquire land compulsorily for the purposes of stations for transforming, converting, or distributing electricity.

LOANS.—The Corporation Electricity Committee is seeking sanction to loans of £50,000 for distributing stations and £100,000 for feeder mains.

New Zealand.—HYDRO-ELECTRIC STATISTICS.—Speaking at the opening of the Power Boards Conference on the subject of hydro-electric developments in the Dominion, the Minister of Public Works stated that the total capital invested in Government developments now amounted to £8,460,505. For the year ended March 31st last the Lake Coleridge scheme showed a total revenue of £186,963 and a working expenditure of £30,131, leaving a gross profit of £156,832. Of this £76,612 was absorbed by interest on loans and £29,847 by depreciation, leav-

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ing a net profit of £50,373. The revenue obtained from the Hora Hora scheme amounted to £135,511. Working expenses totalled £76,231, leaving a balance of £59,280 from which had to be paid £53,045 loan interest and £21,527 depreciation. There was thus a net deficiency on the year of £15,291, which was due largely to dislocation of plant during fire and to flooding and silting after the Arapuni diversion. With regard to the Mangahao scheme there was a total revenue, after deducting £72,563 for a bulk supply purchased, of £114,148, a working expenditure of £34,344 and a gross profit of £79,804. After providing for interest on loans £135,358, depreciation £42,714 and insurance £99, there was a net deficit of £98,367 on the year's working.

Northern Ireland.—BANGOR.—The Borough Council has resolved to apply for sanction to a further expenditure of £10,000 for the laying of additional street cables in connection with the distribution scheme.

NEWRY, Co. DOWN.—The Urban District Council has authorised the town clerk to make application for sanction to a loan of £7,500 for a free-wiring scheme and mains extensions.

Plymouth.—ELECTRIC CABLE EXTENSIONS.—At a meeting of the Corporation Electricity Committee held last week, cable extensions were authorised in 21 streets of the city, involving an expenditure of £3,660.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

CARLISLE.—Lighting: From 6¾d. to 5¾d. per kWh.

LONDON.—*Hornsey*.—Lighting: First 500 kWh, from 4d. to 3¾d. per kWh.

Scarborough.—LOAN SANCTIONED.—The Corporation has received sanction to the borrowing of £45,000 for mains, services, and meters.

Stoke-on-Trent.—LOANS.—The Corporation Electricity Committee has obtained sanction to a loan of £3,300 for the erection of sub-stations at Hem Heath and Porthill. The committee is also to apply for sanction to a general loan of £10,000 for services.

Tramway and Railway Notes.

Birmingham.—TRAMWAY EXTENSION.—The Corporation Tramways and Omnibus Committee is to extend the tramway track from Holly Lane to the Dunlop factory.

Bradford.—RAILLESS-CAR SERVICE INAUGURATED.—A railless-car service to Allerton was put into operation on Sunday last.

Continental.—ITALY.—Work has recently been commenced on the electrification of the railway between Voghera and Varzi, a distance of about 20 miles. The power will be supplied from a transformer station at Godiasco.

FRANCE.—Answering a question in the French Parliament recently, the Minister of Public Works stated that during the last four and a half years 51 persons had been killed by contact with live equipment on the electrified sections of French railways, an average of between 11 and 12 persons per year. In the majority of cases the fatalities were due to the imprudence or carelessness of the persons involved, but in view of the fact that the majority of the fatalities had occurred on one railway company's system, a special Departmental Committee had been appointed to inquire into and report upon measures to be adopted to provide greater security.

Croydon.—DOUBLING THE TRACK.—The Town Council has received sanction to a loan of £1,610 for doubling the tramway track near the "Rising Sun" in North End.

Exeter.—THE TRANSPORT QUESTION.—A special meeting of the City Council was held on Tuesday last at the Guildhall, when a report was presented by the Tramways Committee dealing with the visits of a special sub-committee to Birmingham, Wolverhampton, and Hastings to inspect the alternative systems of transport. The Committee recommended that the Council decide to continue the existing tramway services for three years, from April 1st, 1930, before the expiration of which period the Council can again consider the position, and that the Pinhoe Road tramway be at once extended as far as Hamlyn's Lane. A tabulated statement estimated that there would be a net profit of £381, if railless cars were substituted for trams, to give the same service. It had also been proposed that the Devon General Omnibus and Touring Co. should take over the running of 'bus services in the city, at terms to be arranged by the Council. The Tramways Committee did not recommend the Council to entertain the proposal, which, whatever the terms arranged, would give the company a monopoly of transport in the city. The Committee has made arrangements for the renewal of the Fore Street track, at an estimated cost of £1,500, which is to be defrayed out of the revenue.

Glasgow.—RAILWAY ELECTRIFICATION.—Among the clauses in a Provisional Order being promoted by Glasgow Corporation is one proposing that railways in the city shall be operated by electricity or other motive power, the use of which does not involve the emission of smoke.

Japan.—PROPOSED UNDERGROUND RAILWAY.—The Tokio-Yokohama Electric Railway has applied to the Government for a charter to construct an underground railway from Shinagawa, through Hibiya Park to Tokio. It is considered unlikely that the application will be granted, as the proposed line runs parallel with the unopened line of the Tokio Municipal Electric Bureau.

RAILWAY ELECTRIFICATION.—When the electrification of its mills has been completed, the Seitetsusho (Government Steel Works) is to undertake the electrification of its railway at a cost estimated at 5,000,000 yen.

The Government is considering the electrification of its Joyetsu line and plans are being prepared for the construction of the necessary sub-stations.

London.—EXPRESS TRAMCARS.—The Underground Group is considering the conversion of a section of the London United Tramways track between Hanwell and Uxbridge, Middlesex, into a high-speed light railway. Application has been made to the Middlesex County Council for permission to lay a fenced-off track alongside the road.

GOODS TRAFFIC.—In a memorandum issued recently by the London Goods Railway Company further particulars are given concerning the proposed linking-up of the main line railway systems. So far as the goods traffic is concerned, the effect of the scheme, it is stated, will be to make the four main-line railways into one system by linking them together underneath the city. It will be possible to run rapid express goods services for all through traffic, and the hours now occupied in dealing with this class of traffic reduced to minutes. Goods reaching London from the provinces will reach their points of distribution in 35 to 40 minutes instead of the five to ten days now required. It is estimated that the business interests of London will be saved an annual loss of over £60,000,000 due to traffic congestion. The scheme, if carried out, will entail an outlay of £18,000,000 in wages alone.

Maidstone.—RAILLESS CARS.—Application is to be made to the Ministry of Transport by the Corporation for a Provisional Order authorising it to run railless cars along Gabriels Hill and Lower Stone Street.

Manchester.—NEW TRAMWAY POLICY.—At a meeting of the Transport Committee of the City Council, held last week, the general manager of the undertaking suggested, in a report, that:—(*a*) Car mileage should be watched, and extra mileage curtailed at slack times; (*b*) local rate charges should be reduced; and (c) the Department should cease converting cars into the double-bogie vestibule type. Figures presented showed that the cars this year carried 322,815,524 passengers, the revenue being £1,814,705, showing a decline, as compared with last year, of £40,000. The 'bus passengers increased from 14,931,486 to 20,212,221, and the revenue obtained from the 'buses from £133,962 to £225,388. The report was approved by the Committee, and will be considered at the December meeting of the Council.

TRAMWAY LEASE AGREEMENT.—The Transport Committee has ratified its side of an agreement with the Stretford Urban District Council whereby the lease granted to the city to run trams in the Stretford area can be renewed.

St. Helens.—RAILLESS CARS.—The Corporation is to apply to the Ministry of Transport for a Provisional Order authorising it to run railless cars in the urban district of Haydock from the boundary of the borough in West End Road to the present tramway terminus in Church Road.

Wolverhampton.—RAILLESS CARS.—The Corporation is to apply to the Ministry of Transport for a Provisional Order authorising it to run railless cars within the borough and urban districts of Tettenhall and Wednesfield.

Telegraph and Telephone Notes.

Australia.—AUTOMATIC TELEPHONY.—Further progress in the conversion of the telephone system of the Commonwealth from manual to automatic switching is revealed by a statement issued by the Director of Posts and Telegraphs (Mr. H. P. Brown), as is shown in the following table:—

City.	Total telephones.	Automatic telephones.	Conversions, p.c.
Sydney	114,465	87,772	77
Melbourne	92,876	45,662	49
Brisbane	23,971	9,961	42
Adelaide	31,560	15,611	49
Perth	15,851	16,927	69
Hobart	5,106	2,827	78

According to the programme, the networks of the whole of the capital cities should be converted within five years.

Sir William Noble, a director of the British General Electric Co., Ltd., arrived at Hobart on November 25th in connection with the transfer of the Hobart telephone service from the central battery to the automatic system. Sir William visited Hobart as the representative of the B.G.E. Co., which had the

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task of installing the equipment, and in an interview he paid high tribute to the general efficiency of the Australian telephone and telegraph services. When he was there two and a half years ago he had been very much surprised to find such developments as there then were in both services. Since then there had been great advances, and he thought that on a population basis Australia was in a leading position.

During the twelve months ended June 30th, 1929, some 29,033 telephones were added to the system, making a total of 505,554. An average of 1.88 connections is made for every cancellation of a service, as against 1.22 in the United States.

POST OFFICE FACTORY.—At Sydenham there will be opened shortly a large workshop for the Postmaster-General's Department, where all postal and telephone repair work will be done. It will cost £35,000, and 280 men will be employed.

France.—TELEPHONY.—The completion of the first 50 years of telephony in France was recently celebrated. The first exchange in the country was set up in Paris in June, 1879, and started with seven subscribers! By 1899 there were nine exchanges in Paris with 6,255 subscribers, and 22 with 4,800 subscribers in provincial towns. About that time the service was taken over by the Government. To-day there are about 150,000 subscribers in Paris and 400,000 in the provinces.

Mexico.—TELEGRAPHY.—The Statistical Department of the national telegraph system has recently issued a report for the year ended July last, which shows that there were then 500 telegraph offices in Mexico, 175 of which were combined telephone and telegraph, and 24 radio-telegraph offices. The number of messages transmitted during the year was 5,734,996, an increase of 140,783 over 1927-28. The Mexican telegraph system comprised 23,547 miles of line with 51,534 miles of wire.

Radio-telephony. — SHIP-SHORE SERVICE. — Wireless telephony which has been installed in the *Leviathan* will be opened to the public on December 8th, when the liner is one day out from New York on her way to Southampton. It is reported that the *Berengaria* and *Majestic* are to be similarly equipped. Officials of the Bell Telephone and American Telephone and Telegraph companies will sail in the *Leviathan* to supervise the first public calls.

TRANSATLANTIC CALLS.—The total number of transatlantic radio-telephone calls during the six months ended October 31st was 7,737. The service is self-supporting so far as Great Britain is concerned.

United States.—COAST-TO-COAST RADIO SERVICE.—On November 15th a transcontinental radio circuit between New York and San Francisco was opened by the Mackay radio stations on the Atlantic and Pacific coasts of the United States. This makes another important step in the establishment of the International Telephone and Telegraph co-ordinated communication services.

Radio Notes.

Aerials.—RENTAL.—Householders who have fixed wireless receiving aerials to trees in Enfield Town Park, Middlesex, north of London, are to pay one shilling per year "rent" to the Town Council.

Austria.—HIGH-FREQUENCY INTERFERENCE.—The police of Klagenfurt, capital of Carinthia, have issued an order forbidding the use of high-frequency massage apparatus, X-ray apparatus, and anything similar which may impede radio broadcasting, between 7 p.m. and midnight, says *World-Radio*, unless urgently necessary for the sick, in which case the doctor making use of such apparatus must take the responsibility of proving the urgency to the satisfaction of the authorities.

Denmark. — LICENCE-FEE REDUCTION. — According to an announcement by the Department of Public Works, listeners' licences taken out during the period from December 15th, 1929, to March 31st, 1930, will be reduced to 5 Kroner (about 5s. 6d.) for the remainder of the financial year.

Germany.—LICENCES.—At the beginning of October last there were 2,843,569 radio receiving licences in operation in Germany, an increase of 16,941, or 0.5 per cent., since July last.

New Zealand.—LICENCES.—There are now 45,928 receiving licences in force, which is a substantial increase on the total at April 30th last, when the figure was 35,880. Station 4YA, Dunedin, has been entirely reconstructed, and was officially opened on October 16th. The operator has full view of the studios through plate-glass windows.

GOVERNMENT REGULATIONS.—The Postmaster-General has announced, says *World-Radio*, that the whole of the New Zealand radio regulations are now in course of revision. When the work is completed copies will be procurable by the general public.

Regional Stations.—LONDON ALTERNATIVE TRANSMISSION.—The *Daily Telegraph* understands definitely that the Brookman's Park second wave transmission will not be regularly used until February 3rd, 1930. Meanwhile listeners will probably hear tests in the course of the next few days, when certain portions of the 2LO programme will be broadcast, first on one wave and then on the other. Later on there will be experiments with both waves with different programmes.

SCOTTISH STATION.—B.B.C. engineers are making tests in the Falkirk area for the proposed new Scottish station in the hilly area midway between Glasgow and Edinburgh.

Sweden.—LICENCES.—On October 1st this year the number of licensed radio sets in use was 416,865, or in the proportion of 68.3 per every 1,000 inhabitants, according to a statement of Director Seth Ljungkvist, head of the Radio Bureau of the Swedish State Telegraph Department. This brings Sweden to the second place amongst the nations, the first place being held by Denmark. As regards the total number of radio listeners, Sweden comes third, with England first and Germany second.

Television.—EXTENSION OF SERVICE.—In view of the increased interest of radio manufacturers and others in the television experimental transmission now being conducted from 2LO by the B.B.C. for the Baird Television Company, an extension of the series has been arranged. Since September 30th transmission has taken place five mornings a week at 11 o'clock, which time proved to be very inconvenient, both to the experimenter and the manufacturing companies which are interested. The series is therefore to be extended, and transmission will also take place shortly on two nights a week after broadcasting hours.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—Posts and Telegraph Department. January 7th. Telephone hand sets. (B.X. 5823.)* Contact pressure testers. (B.X. 5821.)*

January 14th. Ringing motor-generator sets for automatic telephone exchanges. (B.X. 5839.)* Telephone indicators. (B.X. 5822.)*

January 28th. Induction coils and register plates. (B.X. 5899.)*

January 13th. State Electricity Commission of Victoria. 2,200-V switchgear and accessories. (B.X. 5827.)*

Belfast.—December 13th. Education Committee. Installation of electric lighting at North Road P.E. School. Specifications (21s.) from the education architect, Victoria Street, Belfast.

Dundee.—December 11th. Electricity Department. Supply of 3- and 4-core e.h.p. and l.p. cable. Specification from general manager and engineer.

Health Department. Electric lighting installation and additions and alterations at Lilybank Day Nursery. Particulars from the city engineer.

Egypt.—CAIRO.—December 28th. Ministry of Public Works. Electric generating and pumping sets for Mankabad Barracks. (B.X. 5842.)*

February 1st. Ministry of the Interior. Centrifugal well pump and direct coupled electric motor with piping and accessories. (A.X. 8811.)*

Halifax.—Town Council. December 21st. Electrician's work in connection with the erection of Girls' High School, Craven Lodge. Specifications, &c., (deposit £2 2s.) from Mr. A. C. Tipple, borough engineer.

Hull.—December 19th. Electricity Department Supply of electricity meters. (November 22nd.)

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India.—December 20th. Bombay, Baroda & Central India Railway Co. Supply of glass boxes, plates and wood separators for accumulators. (See this issue.)

Kirkcaldy.—December 18th. Education Authority. Electric and heating work, at additions to St. Agatha's R.C. school, Methil, and Bell-Baxter school, Cupar. Schedules (deposit £1 1s. each) from Mr. E. Sandilands, architect and master of works, Education Offices, Kirkcaldy.

London.—Central Electricity Board. December 21st. Supply, delivery and erection of 132,000-V transformers for the Mid-East England Electricity Scheme, 1929. (November 22nd.)

January 6th. Supply, delivery, and erection of 132-kV overhead transmission lines (special crossings and high spans), for the North-West England and North Wales Electricity Scheme, 1928. (November 29th.)

WANDSWORTH.—December 11th. Union Guardians. Supply of 18 electric sterilisers. (November 29th.)

ISLINGTON.—January 9th. St. Mary Parish Guardians. Supply and erection of five automatic electric lifts at the Infirmary, Highgate Hill, N. (See this issue.)

METROPOLITAN ASYLUMS BOARD.—January 2nd. Alterations to electric lighting installation at the South-Western Fever Hospital, London Road, Stockwell, and installation of car-washing and disinfecting apparatus at Brook, North-Western South-Eastern and South-Western ambulance stations. (See this issue.)

Manchester.—December 13th. Electricity Committee. Electrically-propelled tower-ladder vehicles. (November 29th.)

December 10th. Delivery and placing into position at the Barton power station of 12 single-phase feeder reactors, and the supply and placing into position in the Manchester area of 125, 250, 500, 750, and 1,000 kVA 6,400-400 V 3-phase, oil-immersed, self-cooled transformers. (November 29th.)

December 17th. Supply and erection of one 6,600-V sheet-steel type transformer kiosk and switchgear. (November 29th.)

Millom.—December 20th. Urban District Council. E.h.p. and l.p. cables, pillar box, &c., and e.h.p. and l.p. switchgear, transformer, &c., for the Haverigg extension scheme. (November 22nd.)

Morocco.—December 17th. Post and telegraph authorities of Morocco at Rabat. Supply of 2 tons of copper wire, 2 mm. dia., and 75 tons of high-conductivity copper wire, 2 mm. dia.

New Zealand.—WELLINGTON.—Post and Telegraph Department. January 13th. Four point jacks. (B.X. 5840.)*

January 16th. Telephone switchboard plug covers. (B.X. 5879.)*

Public Works Department. January 14th. Two air compressors and two electric motors. (A.X. 8784.)*

January 28th. Three 50-kW, oil-immersed circuit breakers for Arapuni. (B.X. 5878.)*

South Africa.—PRETORIA.—December 27th. Posts and Telegraph Department. Telegraph material. (A.X. 8734.)*

BLOEMFONTEIN.—January 10th. Electricity Supply Department. Automatic electric traffic signals. (B.X. 5887.)*

JOHANNESBURG.—January 4th. Stores Department. Automatic traffic signals. (B.X. 5924.)*

January 16th. South African Railways and Harbours. Crude oil engine-driven electric generating sets. (B.X. 5926.)*

CAPE TOWN.—January 7th. Electricity Department. Supply of 3-core 11,000-V cable. (B.X. 5925.)*

Tralee (COUNTY KERRY).—Christian Brothers. Electric wiring installation for new schools, Tralee. McEntee and O'Kelly, Consulting Engineers, 23, Upper O'Connell Street, Dublin. (Returnable deposit, £2 2s.)

Wakefield.—December 18th. West Riding Mental Hospital Board. Wiring for electric light, Wadsley Mental Hospital, near Sheffield. Mr. W. E. H. Burton, West Riding Mental Hospitals Board, Wakefield.

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Australia.—MELBOURNE.—State Electricity Commission.
44,000-V transformers and spares (£2,815); 22,000-V transformers and spares (£5,834).—Weymouths, Ltd.
Lead covered and armoured cable (£1,466).—British Insulated Cables, Ltd.
SYDNEY.—Municipal Council.
Bare copper cable (£18,723).—Wm. Adams & Co., Ltd.
Fibre conduit (£4,731).—Standard Telephones & Cables (Aust.), Ltd.

—*Tenders.*

Ayr.—
Electrical work at new primary school at Heathfield (£234).—M. & R. Young.

Black Notley.—Essex County Council. Accepted :—
Electricity supply at sanatorium.—Switchboard (£101) Christy Bros. & Co., Ltd.; electric light fittings, F. Thomas & Co., Ltd., and Benjamin Electric Co., Ltd.

Brighton.—Corporation.
Gasfilled lamps.—Edison Swan Electric Co., Ltd.

Cheltenham.—Housing Committee. Accepted :—
Wiring houses at Pilley (£444).—F. H. Bastin and Sons.

Connah's Quay.—Urban District Council. Accepted :—
Main extensions and extensions to sub-station equipment (£1,957).—Crompton Parkinson, Ltd.

Glasgow.—Municipal Transport Committee. Recommended :—
Insulated bolts.—British Insulated Cables, Ltd.
D.c.c. wire.—R. Johnson, Clapham & Morris, Ltd.
Armature coils.—Dyer & Young, Ltd.
Special work (tongues and switches).—Titan Trackwork Co., Ltd., Edgar Allen & Co., Ltd., and Hadfields, Ltd.
Special work (junctions).—Edgar Allen & Co., Ltd.

Grimsby.—Watch Committee. Accepted :—
Automatic light signals.—Forest City Electric Co., Ltd.

Hornsey.—Electricity Committee. Recommended :—
Alterations to switchboard (£855).—A. Reyrolle & Co., Ltd.

Hounslow.—Electricity Committee. Accepted :—
Supply of cable (£606).—Enfield Cable Works, Ltd.

London. — POPLAR. — Electricity Committee. Recommended :—
Blow-down plant, £150.—Filtrators, Ltd.
Pipework.—Millwall Engineering Co., £350.
BARKING.—Electricity Committee. Recommended :—
400 kVA transformer at the works of Messrs. Gross, Sherwood and Heald (£186).—Hackbridge Electric Transformer Co., Ltd.
Four-core cable (£351).—Derby Cables, Ltd.

Newmill.—Urban Council. Accepted :—
Supplying and fixing a cubicle at the Council offices sub-station to control the 11,000-volt line to Lee Mills (£104).—Yorkshire Electric Power Co.

Scarborough.—Town Council. Accepted :—
E.h.p. and l.p. cables (£18,531).—British Insulated Cables, Ltd.

Stockport.—
Electrical work in connection with the reconstruction of the premises of G. W. Smith & Co. (1925), Ltd.—McClure & Whitfield.

Stoke-on-Trent.—Electricity Committee. Accepted :—
Overhead wiring and services for Etruria Vale housing estate.—Barnett & Soans.
Overhead service lines on Horwills estate, Trentham, £275.—E. Holloway. (In place of previous tender.)

Tynemouth.—Electricity Committee. Accepted :—
Cable (£372).—Macintosh Cable Co., Ltd.

West Ham.—Board of Guardians. Accepted :—
Fire-alarm system at Whipps Cross Hospital (£324).—F. Hodgson.

Forthcoming Events.

Institution of Mechanical Engineers.—Friday, December 6th. Institution, Storey's Gate, S.W. 7 p.m. Informal meeting. "Diesel Engine Developments." Mr. W. A. Tookey.

Institution of Electrical Engineers.—Informal meeting. Monday, December 9th. Institution, London, W.C. 7 p.m. Discussion on "To Earth or Not to Earth." Opened by Mr. W. R. Rawlings and Mr. T. C. Gilbert.

Thursday, December 12th. Institution, London, W.C. 6 p.m. Joint meeting with the British section of the Société des Ingenieurs Civils de France. "The Electrical Plant and Network of the Société Electrique de la Sidérurgie Lorraine." Mr. L. A. E. Sekutowicz and Mr. A. Evain.

(Meter and Instrument Section).—Friday, December 6th. Institution, London, W.C. 7 p.m. "Alternating-current Potentiometers and their Applications." Dr. C. V. Drysdale.

(Mersey and North Wales (Liverpool) Centre).—Monday, December 9th. University, Liverpool. 7 p.m. "The Heating of Buildings Electrically by Means of Thermal Storage." Lt.-Col. S. E. Monkhouse and Mr. L. C. Grant.

(North-Eastern Centre).—Monday, December 9th. Armstrong College, Newcastle-on-Tyne. 7 p.m. "The Analysis and Measurement of the Noise Emitted by Machinery." Mr. B. A. G. Churcher and Mr. A. J. King.

(North-Midland Centre).—Tuesday, December 10th. Hotel Metropole, Leeds. 7 p.m. "The Heating of Buildings Electrically by Means of Thermal Storage." Lt.-Col. S. E. Monkhouse and Mr. L. C. Grant.

(North-Western Centre).—Tuesday, December 10th. Engineers' Club, Manchester. 7 p.m. Twentieth Kelvin Lecture. "Lightning." Dr. G. C. Simpson, F.R.S.

(Western Centre).—Monday, December 9th. Gloucester. 6 p.m. "The Testing of Porcelain Insulators." Mr. B. L. Goodlet.

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(Dundee Sub-Centre).—Thursday, December 12th. University College, Dundee. 7.30 p.m. "Cable Design." Mr. A. F. Stevenson

(South-Midland Students' Section).—Tuesday, December 10th. Coventry. "Routine Testing of d.c. Machinery." Mr. A. H. Slade.

Institute of Wireless Technology.—Monday, December 9th. Engineers' Club, W. 7 p.m. "Reception of Television." Mr. A. W. Thynne.

Illuminating Engineering Society.—Tuesday, December 10th. Home Office, Industrial Museum, Horseferry Road, S.W., 7 p.m. Discussion on Problems in Illuminating Engineering.

Electrical Power Engineers' Association (London Technical Group).—Tuesday, December 10th. Junior Institution of Engineers, 39, Victoria Street, S.W. 7.15 p.m. "Turbo-Alternators." Mr. R. Livingstone.

(Birmingham Local Technical Group).—Tuesday, December 10th. Chamber of Commerce, Birmingham. "Some Aspects of Power Factor Correction." Mr. C. G. Byers and Mr. W. Hanley.

British Electrical Development Association (North-West Area).—Wednesday, December 11th. E.D.A. Demonstration Bureau, 4, Fountain Street, Manchester. 6.30 p.m. "The Value of Exhibitions to the Electrical Industry." Mr. R. C. Hawkins.

Faraday Society and The Electroplaters' and Depositors' Technical Society.—Wednesday, December 11th. Northampton Polytechnic Institute, St. John Street, E.C., 8 p.m. Joint Meeting.

Institution of Railway Signal Engineers.—Wednesday, December 11th. Institution of Electrical Engineers, Victoria Embankment, W.C. 6 p.m. "Some Notes on a.c. Rectifiers." Mr. F. A. Downes.

Institution of Production Engineers (Luton, Bedford, and District Section).—Wednesday, December 11th. Royal Hotel, Luton, 7.30 p.m. Inaugural meeting. "Progress in Manufacturing Methods." Mr. J. H. Garnett.

Institution of Civil Engineers.—Wednesday, December 11th. Institution, Great George Street, S.W. 6 p.m. Informal meeting. "The Heating of Buildings by Electricity off Supply Mains, with special reference to the problem of Heat-storage and Off-peak Loads." Mr. A. H. Barker.

Institute of Fuel.—Wednesday, December 11th. Burlington House, Piccadilly, W. 6 p.m. "The Coal Burning Art as Applied to Steam Production." Mr. W. D. Wylde.

Institution of Engineers-in-Charge.—Wednesday, December 11th. St. Bride's Institute, Bride Lane, E.C. 7.30 p.m. "Pumps and their Selection for Various Duties." Mr. E. B. Tait.

Institute of Metals (London Local Section).—Thursday, December 12th. 83, Pall Mall, S.W. 7.30 p.m. Joint meeting with the Institute of British Foundrymen. "Metal Melting by Electricity." Mr. D. F. Campbell and Mr. W. S. Gifford.

Junior Institution of Engineers.—Friday, December 13th. Royal Society of Arts, John Street, Adelphi, W.C. 7.30 p.m. Address by the President, Sir Ernest W. Moir, Bart., on "Some Engineering Difficulties and How they were Overcome."

Institution of Engineering Inspection.—Friday, December 13th. Royal Society of Arts, John Street, Adelphi, W.C. 5.30 p.m. "The Trend of Development in Railway Signalling." Capt. B. H. Peter.

Diesel Engine Users' Association.—Friday, December 13th. Caxton Hall, S.W. 3.30 p.m. "A Form of Coupling for Geared Diesel Engines for Land and Marine Purposes." Mr. W. Grose.

Radio Society of Great Britain.—Friday, December 13th. Institution of Electrical Engineers, Savoy Place, W.C.2. 6 p.m. "Tone Compensation and Control for Electrical Gramophones," with demonstration. Dr. N. W. McLachlan.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, December 14th. South Wales Institute of Engineers, Park Place, Cardiff. 6 p.m. "Mining Cables." Mr. W. T. Anderson.

(Western Sub-Branch).—Saturday, December 14th. Swansea. "Electricity in Mines: First Aid." Dr. S. Phillips.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of makers of the following:—

VENUS mirror arc lamp.
ADAPTABLE type of dry battery for flash lamps, &c.
JUNIT tubular heaters.
RIPOGLASS cables.
PROTEON tubes.

Notes.

The Electrical Engineers' Ball, 1930.

Arrangements have been made for holding the Electrical Engineers' Ball on February 7th next at the Hotel Cecil.

In accordance with our usual custom we print below list of the General and Executive Committees:—

General Committee.

Alabaster, H.	Macgregor, J. J., C.B.E.
Alabaster, G. H.	McKinstry, A. E.
Allcock, H.	McClelland, Wm., C.B.
Atkinson, Ll. B.	McMahon, P. V.
Baldwin, O. H.	Mason, A. V.
Balfour, George, M.P.	Matthews, W. Lee.
Bowden, J. H.	Midgley, H. E.
Callender, Sir T. O., J.P.	Mordey, W. M.
Chattock, R. A.	Moss, E. W.
Cooper, A. R.	Nalder, F. H.
Cramb, A. C.	Nash, Sir Ph., K.C.M.G., C.B.
Crawter, F. W.	New, E. S.
Cridge, A. J.	Noble, Sir Wm.
Couzens, H. W.	Page, A.
Elder, T. C.	Partridge, G. W.
Ferranti, Dr. S. Z. de.	Pearce, Dr. S. L., C.B.E.
Fox, E. J.	Pooley, F.
Gatehouse, E. A.	Purves, Sir T. F.
Gill, Frank, O.B.E.	Railing, M. J.
Gillespie, M. M.	Riley, G. E.
Gray, James.	Rinder, A. S.
Gregory, J. P.	Rogers, F. M.
Gridley, Sir Arnold, K.B.E.	Rowell, P. F.
Hadley, A. E., C.B.E.	Russell, Dr. Alexander.
Hardie, Lt.-Col. C., D.S.O.	Sayer, C. E.
Haward, Sir Henry.	Scholey, H., C.B.E.
Highfield, J. S.	Siddeley, H. C.
Hill, C. W.	Sillar, A. M.
Hirst, Sir Hugo, Bt.	Sinclair, Dane.
Hunter, P. V., C.B.E.	Snell, Sir John, G.B.E.
Hughman, R. W.	Sutton, Sir George, Bt.
Kerr, M. J. D.	Taite, C. D.
Kingsbury, J. E.	Taylor, G. M.
Kolle, H. W.	Trezise, J. M. G.
Lackie, W. W., C.B.E.	Walton, A. H.
Leaf, H. M.	Wilson, David.
Leigh, Lt.-Col. F. A. Cortez.	Woodhouse, W. B.
Lonsdale, W. Stanley.	Worsdell, F. E.

Executive Committee.

O. H. Baldwin.	W. S. Lonsdale.
H. W. Couzens.	P. V. McMahon.
A. C. Cramb.	A. M. Sillar.
C. W. Hill.	A. H. Walton.
J. E. Kingsbury	

Hon. Secretaries.

A. M. Sillar. C. W. Hill.

Hon. Treasurer.

J. E. Kingsbury.

Mining Electrical Engineers' "Transactions."

The secretary informs us that he has a stock of Vols. I to XI, 1909 to 1920, of the *Transactions* of the Association of Mining Electrical Engineers, which can be purchased for 5s. per volume, post free, from Mr. Saunders, Regent Buildings, London Road, Derby.

The Radiological Exhibition.

Opened by Mr. A. Greenwood, P.C., M.P., Minister of Health, on December 4th, the exhibition and annual general meeting of the British Institute of Radiology incorporated with the Röntgen Society, lasted for three days. The proceedings, mostly at the Central Hall, Westminster, included the delivery of the tenth Mackenzie Davidson memorial lecture by Prof. Gösta Forssell, whose subject was the radiotherapy of malignant tumors in Sweden. At a meeting of medical members at the Institute, Dr. G. B. Batten opened a discussion on the requirements of clinicians from radiologists and *vice versa*.

On the second day, Prof. S. Russ, Mr. G. Keynes, Dr. M. Donaldson, Dr. J. E. A. Lynham, and Dr. N. S. Finzi took part in a discussion (with opening papers) on aspects of radiation therapy, while Prof. F. L. Hopwood and Miss F. E. Smallman dealt with the use and abuse of radium needles. The twelfth Sylvanus Thompson memorial lecture was delivered by Prof. A. S. Eddington, who entitled it "X-rays in the Stars."

The morning of the third day was devoted to the reading of technical papers, namely: Mr. W. E. Schall, a single-valve plant for diagnosis and deep therapy; Mr. C. Andrews, a mobile X-ray unit; Dr. Ffrangcon Roberts, modern radiological developments in Germany, with special reference to the new Institute at Frankfürt; Dr. A. Orliansky, the output of transformers under different methods of high-voltage rectification; Mr. W. R. Graz, a hot-cathode tube with a rotating anode; and Dr. E. J. H. Roth, the "Mekapion," being ionisation apparatus for the absolute measurment of X-ray dosage.

The afternoon was occupied with papers and demonstrations from the radiological section of the Strangeways Research

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Laboratory, namely: Miss S. F. Cox and Dr. F. G. Spear, tissue culture and its application to radiological problems; the action of X-rays on living cells cultivated *in vitro*; and the immediate and delayed effects of radium on tissues cultivated *in vitro*.

The annual dinner was held at the Trocadero Restaurant on the last evening under the presidency of Mr. C. T. Holland. During the meeting the scientific and technical group of the Royal Photographic Society held an exhibition depicting the history and development of the scientific and industrial applications of X-rays, being the first of a series illustrating the uses of photography in the service of man.

The exhibition of apparatus will be dealt with in a later issue.

Overhead Lines Inquiry at Doune.

A Ministry of Transport inquiry was held at Doune, Perthshire, on November 26th, in connection with the proposal of the Grampian Electricity Supply Co., Ltd., to erect overhead lines through the town. Both the local Town Council and the County Council opposed the application. Mr. H. H. Partington, general manager of the company, stated that with overhead works it would cost 30s. to £2 per light, while with underground lines the cost would amount to £3 10s. or £4. The company proposed to erect the poles entirely on the pavements, and there was nothing in the construction of overhead lines that would affect the amenities of the town. Having gone into details as to the cost of construction, Mr. Partington said that the effect of his conclusions was that unless they could erect the installation by the overhead system they could not go on with it at present.

Answering counsel for the company, the Provost said that the Council did not know when it refused the company's application that if overhead works were not allowed Doune would not get an electricity supply. Even had it been known, he did not think it would have altered the Council's decision, because the burgh was adequately supplied by gas. He was, however, a strong believer in electrical development where that was feasible. The decision will be announced later.

The Motor Cycle Exhibition.

One of the features to be noticed at the International Motor Cycle and Pedal Cycle Show (Olympia, London, November 30th to December 7th) is the continued development of electric lighting equipment for solo and combination machines. For instance, the British Thomson-Houston Co.'s equipment is of three kinds: mag-generator, separate generator, or a secondary battery without any generating equipment may be used. The type PA generator is a special permanent-magnet spigot-mounting machine of relatively large diameter and small length, particularly suitable for incorporating with the crank-case or chain-case cover castings. It is designed to run at 1.25 to 1.5 times engine speed, depending on the cycle gear ratio. Type CA 3,000 generator is a 3-in. diameter tubular eccentric machine of the wound-field type which gives 6 volts and operates on the auxiliary brush principle, which limits the charging current at high speeds, and has a maximum current of 6 amperes, the cut-in speed being 900 r.p.m. and the speed at maximum output 2,800 r.p.m. While both the foregoing are designed for special requirements, the mag-generator is of universal application, and can be fitted to almost any motor cycle by mounting it on the magneto platform, in place of an existing magneto, without any modification to the height of the platform being necessary. All B.T.-H. lighting equipment includes a 6-volt battery in a moulded container specially constructed to withstand severe vibration, and a 7-in. headlamp fitted with a four-position switch, an illuminated ammeter registering the generator input to the battery, and separate "bright" and "dim" bulbs. Magnetos occupy a position of prominence and the impulse starter, in conjunction with the magneto, produces an intense spark for starting with quite small applied effort.

The Cardiff Engineering Exhibition.

The annual Engineering Exhibition organised by the South Wales Institute of Engineers was held at the Drill Hall, Cardiff, from November 27th to December 6th. The electrical exhibits included many interesting and new features. Brookhirst Switchgear, Ltd., showed a representative selection of hand-operated and automatic a.c. and d.c. control panels. Messrs. A. Reyrolle & Co., Ltd., exhibited a metal-clad oil-immersed ring main isolator with provision for teeing off a small supply; also the Reyrolle-Holmes automatic traffic control. In addition to their usual lines, Messrs. Ferranti, Ltd., exhibited a 33,000-V lightning and surge absorber. The exhibit of Messrs. Gent & Co., Ltd., included a special signalling arrangement introducing a visible flicker obtained by means of mercury contacts operated by solenoid and a powerful motor-operated alarm bell. Switchgear & Cowans' stand included 11,000-V, 150,000- and 250,000-kVA oil switch units incorporating the Whitehead principle of internal isolation, also 250-kVA, 11,000-V transformers, and a typical pole mounting outdoor transformer by Bruce Peebles. Messrs. Geo. Kent, Ltd., exhibited an electrically-operated indicator for measuring gas pressure and transmitting indications to a distance. The Rapid Magnetting Co. displayed on its stand a 26-in. magnet to lift 7 tons, and its patent shute for separating tramp iron from pulverised fuel. Haslam and Stretton, Ltd., representing various electrical manufacturers, showed a comprehensive range of Eversheds & Vignoles measuring instruments, including the new bridge "MEG" and a model demonstrating a method of testing earth plates. Miners' electric safety lamps were well represented, the principal features on the various stands being: the Ceag Co.: various types of cap and gas-detecting lamps; Oldham and Co.: gas-detecting device; the "Thor" Company: a new type of well glass developed in conjunction with the Holophane Company incorporating its prismatic principle; the Wolf Company: a nickel-cadmium accumulator, the Gulliford gas indicator, and compressed air turbine feeding six 40-W lamps for illuminating coal faces. The stand of Messrs. W. B. Dick & Co., Ltd., was devoted to lubricating oils primarily intended for high-speed reciprocating engines, compressors, turbines, &c., in collieries.

The entrance to the exhibition was effectively illuminated by means of reflector fittings supplied by the Electric Street Lighting Apparatus Co., Ltd.

Official visits were paid to the exhibition on November 30th by the local branches of the Association of Mining Electrical Engineers and the National Association of Colliery Managers. Members of the Western Centre of the Institution of Electrical Engineers are visiting the Exhibition to-day (Friday).

Appointments Vacant.

Plumber-jointer electrician for Brierfield Urban District Council. Switchboard attendant at Kearsley power station for the Lancashire Electric Power Co. Assistant to mains engineer for the Newcastle and District Electric Lighting Co., Ltd. Draughtsman for Manchester Corporation. Full-time assistant master to teach electrical engineering and elementary mathematics at the Hackney Technical Institute. Assistant examiners in Patent Office. Borough electrical engineer and manager for Wolverhampton Corporation. Technical assistant in the testing department of an Admiralty establishment at Portsmouth. Overhead lines engineer for Hull Corporation. (See our advertisement pages to-day.)

National Smoke Abatement Society.

The first issue of the official journal of the National Smoke Abatement Society, *Clean Air*, Autumn, 1929, has just been published. It represents a good start, and contains several interesting articles, including a report of this year's conference of the Society at Buxton. It is to be issued quarterly at the price of 1s., or 2s. 6d. per year, tax free.

The Electrical Association for Women.

Recently, before the South Wales and Monmouthshire branch of the Electrical Association for Women, Mr. T. Batten lectured on "Furnishing Your Home with Light."

The North Wales Branch of the Association celebrated its first birthday with a reception and luncheon at Colwyn Bay on November 30th. Mrs. S. Z. de Ferranti presided, and was supported by Dr. Ferranti, Miss Haslett, Lady Brooks, Mrs. Hyde, Mrs. Price-White, and a representative assembly of over 100 members and their friends.

Institution Notes.

Institution of Electrical Engineers.

SOUTH-MIDLAND DINNER.—The annual dinner of the South-Midland Centre of the Institution was held at the Grand Hotel, Birmingham, on November 29th, 1929. The chairman of the Centre, Mr. G. R. J. Parkinson, M.I.E.E., presided over a gathering of some 350 members and guests.

After the loyal toast, the health of the Institution of Electrical Engineers was proposed by the Rt. Hon. Neville Chamberlain, P.C., M.P., who said that his only connection with electricity was that he had once been Postmaster-General. Electricity was an important factor in the commerce by which this country must live. The Act of 1926 was an attempt by the Government then in Office to cheapen electricity, mainly by the pooling of resources and the standardisation of plant. It was not, he believed, popular when it was first introduced, but he believed signs of success were apparent already. He was pleased to notice an awakening to the need for preserving the remaining beauties of our country, but with regard to the pylons on the South Downs and the threat to the purity of London by the proposed power station at Battersea, they need have no fear from the work of Sir Andrew Duncan and his colleagues. The Institution was the centre for the co-ordination and distribution of technical knowledge, and was recognised as such by the Government. He was glad to note the prosperity of the constructional side of electrical engineering, which he attributed to the fact that experience gained in the home market had enabled manufacturers to compete effectively in foreign markets. Col. Sir Thos. Purves (president, I.E.E.), responding, said that the Institution, like the British Empire, had had its problems due to its evolution as an organism, and had found it necessary, with the help of the local Centres, to place its constitution upon both a functional and territorial basis. The Institution might be termed an imperial democracy. Presidents of the Institution had generally no opportunity of gaining any knowledge of the Centres, until they had assumed office and visited them. He was glad to see the awakening public conscience in regard to pylons; it diverted attention from the little telegraph and telephone lines running overhead throughout the country.

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Mr. G. R. J. Parkinson then proposed the toast of "Kindred Associations and the Guests." He referred, among others, to the distinguished services of the Rt. Hon. Neville Chamberlain, which men of all parties would acknowledge, and the importance of sound Press publicity. He took the occasion to congratulate Mr. Forrest on his forthcoming succession to the position of chief engineer at Birmingham. He would not wish Mr. Chattock happiness in his well-earned rest, as rest would not be possible to Mr. Chattock.

Sir Andrew Duncan, in a brief reply, said that Birmingham had provided opponents of the legislation of 1926, but now that the Act was in operation their erstwhile opponents could be relied on to co-operate for its success. He looked forward to a great expansion of railway electrification.

Mr. S. H. Holden proposed the health of the chairman, and the dinner terminated in a re-union.

The local branch of the Electrical Contractors' Association held a dance on the same evening in aid of the Electrical Trades Benevolent Institution, and some of those present at the dinner took the occasion to support this worthy cause.

MERSEY CENTRE DINNER.—There was a record attendance at the annual dinner of the Mersey and North Wales (Liverpool) Centre of the Institution at Liverpool on November 27th. All the speeches sounded an optimistic note, and whilst there was a tendency to be retrospective, it was admitted that the activities of the Electricity Commissioners and the Central Electricity Board were bound to be advantageous. Prof. E. W. Marchant, D.Sc., M.I.E.E., presided. Dr. H. J. W. Hetherington, M.A., vice-chancellor of Liverpool University, in proposing "The Institution of Electrical Engineers," said that professional service tended to improve in quality as the Institution became conscious of its corporate responsibility to the community it served.

Col. Sir T. F. Purves, O.B.E., M.I.E.E., president of the Institution, remarked in a humorous speech that the proposed trans-atlantic telephone cable, which people would be able to use for about £3 per minute, would have one great virtue—it would cure his countrymen of the bad habit of stuttering. As every stutter would cost 6d., there would be every incentive to faultless speech. The relationship between the Institution and its various Centres was extraordinarily happy. It recognised its responsibilities and, therefore, could not distribute its favours loosely or promiscuously. From the local Centres had emanated many of the ideas that had made the constitution of the Institution so successful and flexible, and had enabled them to combine freedom with centralised allegiance to the whole.

The Lord Mayor of Liverpool (Councillor Lawrence Holt, J.P.), proposed "The Electrical and Allied Industries," the technical excellence of which was one of the proud boasts of this country. He hoped that the position would always be maintained, but uttered a word of caution:—"Let us dig deeper foundations and make sure that we shall possess an electrical edifice that will survive for all times. Short cuts to immediate prosperity are dangerous."

Lord Cozens-Hardy, D.L., said that, in spite of its adoption by political parties as a panacea for all ills, electricity had entered completely into the daily lives of every individual and continued to spread with amazing regularity. One hoped progress would not be impeded by the novel and interesting departure in national organisation for which the Electricity Commissioners were responsible. In some ways they seemed to be a kind of legalised version of the bureaucratic usurpations against which Lord Hewart had so ably protested, yet one must recognise that some sort of co-ordination (that blessed word!) was necessary if electrical development was not to be impeded.

That there should be so little unemployment in electrical engineering was not entirely attributable to the special abilities of those engaged in the trade, but they could at least claim that they had made good use of the vast opportunities which the scientific discoveries of the last 50 years have brought within their reach.

Mr. V. Watlington, M.I.E.E., said that the industry was based primarily on the foundations laid in the technical colleges and universities. The industry required fresh brains which must come from the bottom and pass to the top, for an industry that did not grow from the bottom became stagnant. Research in such a highly technical industry as electrical engineering was of immense value, yet it was difficult to get people to take up research work, because the rewards were not the same as those which could be obtained in the commercial sphere. Without research the commerce attached to the electrical industry could not flourish. Much use had been made of the word "rationalisation," of which everybody was a little tired. In the electrical industry it meant striving to have a certain number of works employed to capacity, instead of a larger number working at only 60 per cent.

The health of "Our Guests" was proposed by Mr. P. J. Robinson, Liverpool city electrical engineer, and responded to by Prof. L. R. Wilberforce, M.A., in a witty speech.

Mr. A. E. Malpas, who deputised for Mr. S. E. Britton, Chester, submitted a toast in honour of the chairman, Prof. E. W. Marchant, D.Sc., M.I.E.E., who said it was the business of universities to train men in technical knowledge and fundamental principles. If the universities taught only technical things their students would be out-of-date before they went into practice. Prof. Marchant paid generous tribute to Mr. O. S. Waygood, hon. secretary of the Centre.

INFORMAL MEETING.—At the informal meeting of the Institution held on November 25th, Mr. R. Grierson being in the chair, when Mr. C. Wade opened a discussion on "Wooden Poles for Transmission Lines and their Preservation." His remarks were mainly concerned with the treatment of poles by creosote, and he exhibited a number of slides and specimens of woods illustrative of practice. Many G.P.O. telegraph creosoted poles had been standing for 50 years or more. Mr. Wade showed a view of a travelling plant for heating and creosoting poles on site in Sweden, where suitable trees abounded and where apparently it was less easy to transport the timber. Various trees that have been applied to the use of overhead lines were considered: larch or spruce could not be satisfactorily substituted for red pine. On the question of helping employment by substituting ferro-concrete or steel poles for wood, it was stated that, though steel and concrete were British products, the extra labour on timber, together with carriage by British ships from overseas, might provide as much employment.

Mr. G. V. Twiss did not think anyone could dispute the claims Mr. Wade made for wodden poles. He thought it uneconomic to use wood for 132,000-V lines, mainly on account of length, but he knew of poles on 66,000-V lines, and he believed in the U.S.A. they had been used for 100,000-V. Regarding maintenance, he knew of a number of steel masts which have been in service for 30 years without any appreciable trouble.

Mr R. H. Herford said that in many cases the creosote drained from the pole into the surrounding earth, and so probably served to maintain the timber. The serious shortage of Scotch fir (*Pinus Sylvestris*) which is undoubtedly the most suitable for poles, had compelled experiments on larch and spruce, and a new treatment showed great probability of overcoming the resistance to penetration by those trees.

Messrs. S. C. Bartholomew, R. G. Bennett, R. Grigg, A. F. Harmer, N. Prentice and E. S. Ritter also spoke.

WEST WALES (SWANSEA) SUB-CENTRE.—On November 29th, under the chairmanship of Mr. J. W. Burr (electrical engineer and manager to the Swansea Corporation), Mr. R. Borlase Matthews repeated the paper he recently presented in London dealing with the 1929 summer visit of the I.E.E. to France. It was illustrated with kinematograph films taken by Mr. Bertram Thomas and the author, also by lantern slides made by Mr. F. Hope-Jones (London) and by Mr. C. Wilson (Birmingham). Interest was added to the proceedings by the fact that several Swansea members had taken part in the visit. Some films were also shown of previous I.E.E. visits to Newcastle and Scotland. The discussion chiefly turned upon the wonderful load factor of nearly 95 per cent. that is obtained in the Pyrenees plant, and how it was obtained.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. P. J. PYBUS has been appointed a joint-deputy chairman of the Phœnix Assurance Company.

Mr. H. A. MACRAE, M.B.E., Assistant Japanese Secretary at the Tokio Embassy, has been appointed Commercial Secretary at Tokio, in the place of Mr. R. Boulter, C.M.G., who was recently appointed Trade Commissioner at Singapore. Mr. Macrae has had considerable experience of the duties of his new post.

Standard Telephones and Cables, Ltd. announce the following changes in staff:—Mr. H. C. TRENAM resigns his position as Deputy Manager in order to accept the appointment of Assistant European General Sales Manager of the International Standard Electric Corporation. Mr. F. J. E. BRAKE relinquishes his position of Sales Manager to become Technical Director of Standard Telephones and Cables, Ltd. Mr. J. W. KEEFE is appointed Sales Manager of Standard Telephones and Cables, Ltd. Mr. H. A. P. DISNEY resigns his position as Secretary to Standard Telephones and Cables, Ltd., in order to take up special duties with the International Standard Electric Corporation. Mr. H. G. PATERSON has been

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appointed to the position of Secretary of Standard Telephones and Cables, Ltd.

In our last issue we mentioned the pending retirement of Mr. R. A. CHATTOCK from the post of city electrical engineer, Birmingham. At its last meeting the Birmingham Electric Supply Committee placed on record its "appreciation of Mr. Chattock's eminent services in the building up of the highly successful electrical undertaking which the city now possesses." After giving careful consideration to the question of appointing a successor, the Committee decided to recommend the appointment of Mr. FRANK FORREST, M.I.E.E., M.I.Mech.E., as city electrical engineer from the date of Mr. Chattock's retirement, January 25th next. The salary proposed is £1,800 per annum.

Mr. E. J. JENNINGS, F.C.I.S., Assoc. I.E.E., who has been secretary to the Department for the past twelve years, is

Elliott & Fry] [*London.*

Mr. E. J. Jennings, F.C.I.S., Assoc. I.E.E.

Secretary and Commercial Manager of the Birmingham Electric Supply Department.

responsible to the Committee for the commercial management of the undertaking, and the Committee considers Mr. Chattock's impending retirement a fitting opportunity, which it has taken, of altering the title of Mr. Jennings's office to that of secretary and commercial manager. The city electrical engineer will continue to be responsible for the whole of the engineering side of the Department, both generation and distribution. As our readers are aware, Mr. Jennings is hon. secretary of the Electrical Section of the British Industries Fair, Birmingham.

A well-attended gathering of members of the staff of the Yorkshire Electric Power Co. assembled at Leeds last week for the joint purpose of bidding farewell to a Mr. R. H. HARRALL and felicitating Mr. OLDROYD and Miss CROWTHER on the occasion of their marriage. Mr. Harrall, who has been a mains engineer on the staff of the company for 11 years, is leaving to take up an appointment as mains superintendent in the Blackburn Corporation Electricity Department. He was presented with a clock, a loud-speaker, and an illuminated address. Mr. Oldroyd and Miss Crowther have served on the company's staff for 17 and 14 years, respectively. They were presented with a pewter tea-service, a canteen of cutlery, a case of fish-eaters and an illuminated address. Speeches were made by Mr. W. B. Woodhouse (engineer and manager). Mr. J. J. H. Stansfield (secretary), Mr. H. C. Fraser (superintendent of organisation) and Mr. S. R. Siviour (chief mains engineer). The evening concluded with music and dancing.

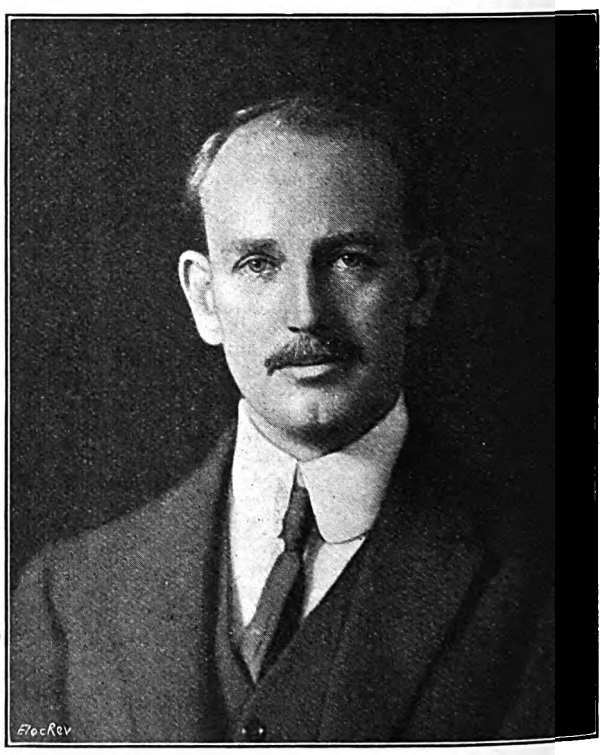
The Hewittic Electric Co., Ltd., states that Mr. A. MANIGHETTI, A.M.I.E.E., is leaving the company to take up a position with the Sterling Varnish Co. Mr. Manighetti has been with the Hewittic Co. for fourteen years.

Mr. P. SARVENT, of the Hammersmith Electricity Department, has been appointed by the Leeds Corporation Electricity Committee as resident engineer to be in charge of the new super-power station at Kirkstall, now in course of construction. The appointment, subject to confirmation by the City Council, carries a basic salary of £750 per annum. Mr. Sarvent will take up his new duties in February.

Mr. H. F. FIELDS, of the Leatherhead & District Electricity Co., Ltd., has been appointed station superintendent at the Horsham electricity works at a salary of £300 per annum.

Subject to confirmation by the Town Council, the Derby Tramways Committee has confirmed the appointment of Mr. P. W. BANCROFT as manager of the Corporation tramways. Mr. Bancroft has been in the Corporation's service for about 29 years.

We reported in our issue of October 4th that Dr. F. E. SMITH, C.B., C.B.E., F.R.S., had been appointed Secretary to the Committee of the Privy Council for Scientific and Industrial Research. On Saturday last he was elected Secretary of the Royal Society in succession to Sir J. H. Jeans. Dr. Smith entered the Royal College of Science as a National Scholar in 1895, and was the Senior Associate in Physics in 1898. He remained as demonstrator in physics until 1900, when he joined the National Physical Laboratory. There he formed one of a small company of pioneers who, under the directorship of Sir Richard Glazebrook, laid the scientific foundation of that institution. His earliest work was connected with electrical standards, the precision of comparison of which and their absolute determination he raised to a very high degree of accuracy. He developed many forms of the Wheatstone and Kelvin bridges for precise measurements of resistance and for accurate work with platinum resistance thermometers, and these are now in general use. A classical piece of work was conducted by him in co-operation with Professors Ayrton and Mather on the absolute measurement of current, the probable error of measurement in C.G.S. units being not greater than one in fifty-thousand. Subsequently, he developed a silver voltameter which bears his name, and which is universally accepted as the most reliable form, in that there is no septum or envelope between the anode and cathode. Another successful development was the Weston cadmium cell with a slightly acid solution. A second classical piece of work was the absolute measurement of resistance by a modified form of Lorenz apparatus designed by Dr. Smith and installed at the National Physical Laboratory. This, and other work of a similar nature, led Dr. Smith to become a foremost advocate of the absolute system of measurement and the abolition of electrical standards based on other systems, though closely related to the C.G.S. system. He has also developed various magnetometers for the absolute measurement of magnetic intensity. One of these instruments now forms the standard for the measurement of horizontal intensity at the Magnetic Observatory at Abinger, and a second is in use by the Ordnance Survey. In 1920 Dr. Smith left the National Physical Laboratory to assume the position of Director of Scientific



Swaine] [*London.*

Dr. F. E. Smith, C.B., C.B.E., F.R.S.

The new Secretary of the Royal Society.

Research at the Admiralty. There he organised the Scientific Research and Experimental Department, and became responsible for the general conduct of the many phases of naval research. He was president of the Physical Society in 1923-24, and served as one of the hon. secretaries of the British Association from 1922 until last month, when he resigned on being elected Secretary of the Royal Society.

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The Maidstone Town Council has decided to grant a gratuity of £1,050 to the borough electrical engineer, Mr. E. E. HOADLEY, for special services rendered. It is stated that the sum was agreed upon when Mr. Hoadley was about to accept another appointment. When this decision was arrived at on November 27th, the chairman of the Electricity Committee mentioned that had the Council obtained other expert advice it would have cost at least £6,000.

At a recent meeting of the Council of the Electrical Contractors' Association, Mr. W. H. WALTON, immediate past-president, was elected a fellow of the Association. Mr. Hawkins, on behalf of the London branch, has presented a portrait of Mr. Walton to the Association.

Mr. H. MOZLEY, manager of the Burnley Transport Department, is retiring on March 31st next, after 29 years' service. He is to receive an illuminated address recording appreciation of his long and faithful service. Mr. Mozley was manager of the company from which the Corporation acquired the tramway service. The Council has decided to advertise for a successor at a salary of £550 per annum, rising by two increments of £25, to £600.

At Sheffield Corporation Tramways Committee, the general manager reported the resignation of Mr. R. C. MOORE, traffic assistant, he having been appointed traffic superintendent of the Stockton-on-Tees omnibus undertaking.

Mr. W. A. ROBINSON, A.M.I.E.E., has been appointed mains superintendent in the City of Winchester Electricity Department. We understand that an extensive rural electrification scheme is being proceeded with in this undertaking's area.

On December 2nd, at the Electricity Office, Loughborough, the borough electrical engineer, Mr. G. J. HOLLYER, was presented with fountain pens and a pen stand by the employés of the undertaking. Mr. Statter expressed appreciation of the cordial relations which had existed between Mr. Hollyer and the staff during his stay in Loughborough; he also extended to the new engineer, Mr. Fowles, a hearty welcome to Loughborough. Alderman Stenson, chairman of the Electricity Committee, made the presentation, and wished Mr. Hollyer success in his new appointment as engineer and manager of the Torquay undertaking.

Obituary.—Mr. W. CLAYTON.—The death has occurred, at the age of 40 years, of Mr. William Clayton, a partner in the firm of Messrs. Clayton & Rogers, electrical contractors, Plymouth. Several representatives of the electrical industry were present at the funeral service, and the floral tributes included wreaths from the Electrical Contractors' Association, the employés of Messrs. Clayton & Rogers, and from a number of electrical contracting firms.

Mr. W. R. BOWER.—The death occurred on November 20th of Mr. William Richard Bower, who was for over 30 years head of the Physics and Electrical Engineering Department of the Huddersfield Technical College. He retired from this position at the end of 1926.

Mrs. F. M. FLETCHER.—We regret to record that the wife of Mr. F. M. Fletcher, A.M.I.E.E., borough electrical engineer to the Darwen Corporation, passed away in a Blackburn nursing home, following an operation, on Saturday last.

Mr. A. E. SLATER.—Mr. A. E. Slater, partner in the electrical business of Bassano & Slater, and later proprietor of Slater & Oakes, both of Derby, met his death recently at the age of 74 years as the result of a motor accident.

Mr. C. A. BLASCHECK.—We regret to record the death, which occurred on November 26th, of Mr. Charles Albert Blascheck, M.I.E.E., city electrical engineer of Canterbury. He was 55 years of age, and in 1902 he succeeded Mr. Norman Staniland as city electrical engineer. He came to Canterbury from Norwich, where he had been chief assistant electrical engineer. Prior to that he was with the St. James's & Pall Mall Co.

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Hyperlite Units, Ltd.—Private company. Registered November 29th. Capital, £100 in £1 shares. Objects:—To carry on the business of manufacturers of "Hyperlite" units, electrical signs and apparatus, &c. The subscribers (each with one share) are:—A. T. Dawles, 12, Gloucester Road, Romford, Essex, clerk; C. P. Brightwell, 3-4, Lincoln's Inn Fields, W.C., clerk. The first directors are not named. Registered office: 25, Islington Green, N.1.

Radium Electric, Ltd.—Private company. Registered November 25th. Capital, £5,000 in £1 shares. Objects: To adopt an agreement with Erko Radium Kompresse, M. Munzer, and to carry on the business of manufacturers of and dealers in electrical and radio-active apparatus of all kinds, including an electrically-heated compress pad or bandage adapted for medical, surgical or curative purposes, &c. The directors are: C. P. Lister, Combe House, Dursley, Gloucester; R. B. Lister, "The Elms," Stone, Gloucester (directors of R. A. Lister and Co., Ltd.); R. P. Forster, 65, Blenheim Terrace, N.W.8. Registered office: 24, Grosvenor Gardens, S.W.1.

R. J. Robinson & Co., Ltd.—Private company. Registered November 23rd. Capital, £1,000 in £1 shares. Objects: To carry on the business of engineers, founders, smiths and machinists, electricians, electrical engineers, &c. The provisional directors are: B. G. Stone, Myrtle House, Brackenboro Road, Louth, estate agent; R. J. Robinson, Inglenook, Brackenboro Road, Louth, electrical engineer. Solicitors: Falkner, Son & Roberts, Louth, Lincs.

Bell Radio Co., Ltd.—Private company. Registered in Edinburgh on November 23rd. Capital, £3,000 in £1 shares. Objects: To acquire the business of the Bell Radio Co., wireless specialists, 33, George Street, Edinburgh. The directors are: J. Ferguson, 64, Merchiston Avenue, Edinburgh, paint merchant; L. Bell, 16, Barnton Gardens, Davidson Mains, Edinburgh, engineer; W. Sime, 22, Panmure Place, Edinburgh. Qualification: 100 shares. Registered office: 8, Frederick Street, Edinburgh.

Rigby & Partners, Ltd.—Private company. Registered November 26th. Capital, £500 in £1 shares. Objects: To carry on the business of electrical engineers and contractors, dealers in and erectors of electrical plant, equipment, apparatus and accessories, &c. The subscribers (each with one share) are: Eleanor M. Herbert, 140, Belgrave Road, Edgbaston, Birmingham, typist; F. E. Francis, 10, High Street, Smethwick, Staffs, law clerk. The first directors are to be appointed by the subscribers. Secretary: F. E. Francis. Registered office: 53, Victoria Street, Westminster, S.W.1.

Ramsbottom Electrical Heating & Lighting Co., Ltd.—Private company. Registered November 27th. Capital, £500 in £1 shares. Objects: To carry on the business of electricians, electrical engineers and contractors, mechanical and general engineers, cabinet makers, workers and dealers in electricity, gramophones, wireless sets, &c. The directors are: F. Haworth, Bergvik, 170, Peel Brow, Ramsbottom; E. Holden, 25, Bridge Street, Ramsbottom. Registered office: 25, Bridge Street, Ramsbottom.

British Telehor, Ltd.—Private company. Registered November 21st. Capital, £100 in £1 shares. Objects:—To manufacture or deal in any equipment used in connection with transmitting or receiving, producing, recording or reproducing by electrical or any other means any matter, whether consisting of sounds, images, signals, impulses, or otherwise, &c. The subscribers (each with one share) are:—A. Fletcher, 31, Princes Court, Wembley, solicitor; A. E. Spencer, "Forest Dene," Oakhill Crescent, Woodford Green, clerk. The first directors are to be appointed by the subscribers. Solicitors: Herbert Oppenheimer, Nathan & Vandyk, 1, Finsbury Square, E.C.2.

Official Returns of Electrical Companies.

Pinnacle Investment Trust, Ltd.—E. L. Donald, Atlantic House, 46, Holborn Viaduct, E.C.1, was appointed receiver and manager on November 13th, under powers contained in debenture dated August 1st, 1929.

"M.P.A." Wireless, Ltd.—Issue on November 1st of £500 and on November 7th, 1929, of £600 debentures, parts of a series already registered

New System Private Telephones, Ltd.—Capital, £20,000 in £1 shares. Return dated July 22nd, 1929. 15,000 shares taken up. £13,000 paid. £2,000 considered as paid. Mortgages and charges, nil.

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Burndept Wireless (1928), Ltd.—Capital, £200,000 in 5s. shares. Return dated September 27th, 1929. 620,021 shares taken up. £102,504 0s. 6d. paid (being 5s. per share on 20,007 shares and 3s. 3d. per share on 600,014 shares). £52,501 4s. 6d. considered as paid (being 1s. 9d. per share on 600,014 shares). Mortgages and charges, nil.

General Electric Co., Ltd.—Capital, £7,600,000 in 1,800,000 6½ per cent. "A" preference, 1,800,000 7½ per cent. "B" preference, 2,400,000 ordinary and 1,600,000 British ordinary shares of £1 each. Return dated July 18th, 1929. 1,800,000 "A" preference, 1,800,000 "B" preference and 2,253,645 ordinary shares taken up. £4,831,819 paid on 1,575,540 "A" preference, 1,777,109 "B" preference and 1,479,170 ordinary shares. £1,021,826 considered as paid on 224,460 "A" preference, 22,891 "B" preference and 774,475 ordinary shares. Mortgages and charges: £3,068,060.

Tetbury Electric Supply Co., Ltd.—Capital, £6,000 in 600 cumulative preference shares of £5 each and 3,000 ordinary shares of £1 each. Return dated July 3rd, 1929. 300 preference and 2,107 ordinary shares taken up. £3,607 paid. Mortgages and charges, nil.

British Electric Traction Co., Ltd.—Capital, £2,998,397 15s. in £712,744 5s. 6 per cent. cumulative participating preference stock, £1,326,263 10s. 8 per cent. non-cumulative preferred ordinary stock and £167,676 deferred ordinary stock and 287,256 6 per cent. cumulative participating preference shares and 504,458 ordinary shares of £1 each. Return dated July 1st, 1929. All the preference and preferred ordinary stock and £147,888 deferred stock issued and fully paid up. Mortgages and charges: £1,665,331 18s. 9d.

I.T.C., Ltd.—Capital, £20,000 in £1 shares. Return dated July 22nd 1929. 15,000 shares taken up. £15,000 paid. Mortgages and charges, nil.

Teignmouth Electric Lighting Co., Ltd.—Capital, £50,000 in 20,000 7 per cent. cumulative preference and 30,000 ordinary shares of £1 each. Return dated June 6th, 1929. All shares taken up. £49,500 paid. £500 considered as paid. Mortgages and charges: £12,500.

Radioco, Ltd.—Capital, £2,500 in £1 shares. Return dated September 26th, 1929. 2,200 shares taken up. £2,200 paid. Mortgages and charges, nil.

Wark and District Electric Lighting Co., Ltd.—Capital, £1,500 in £1 shares. Return dated June 4th, 1929. 1,500 shares taken up. £1,500 paid. Mortgages and charges, nil.

Reproduction, Ltd.—O. F. Falk, 19, Ironmonger Lane, E.C., was appointed receiver and manager by Order of Court dated November 15th, 1929.

Midland Rubber Co. (1913), Ltd. (formerly Midland Rubber Goods Manufacturing Co., Ltd.).—C. H. Smith, Phœnix Chambers, Colmore Row, Birmingham, was appointed receiver on November 20th, 1929, under powers contained in first mortgage debenture dated November 15th, 1923.

West African Telegraph Co., Ltd.—Capital, £400,000 in £10 shares. Return dated September 11th, 1929. 23,109 shares taken up. £231,090 paid. Mortgages and charges, nil.

Anglo-Argentine Tramways Co., Ltd.—Capital, £11,000,000 in 800,000 first preference and 710,000 second preference shares of £5 each and 862,500 ordinary shares of £4 each. Return dated July 9th, 1929. 640,000 first preference, 610,000 second preference and 675,000 ordinary shares taken up. £850,000 paid. £8,100,000 considered as paid. Mortgages and charges: £70,660 annuity; £4,465,674 4 per cent. debentures; £1,733,380 4½ per cent. debentures; and £6,000,000 5 per cent. debentures.

Electric & General Investment Co., Ltd.—Capital, £201,500 in 19,900 preference and 20,000 ordinary shares of £5 each, and 40,000 deferred shares of 1s. each. Return dated July 23rd, 1929. All shares taken up. £121,500 paid (being £5 per share on the preference, £1 per share on the ordinary, and 1s. per share on the deferred shares). Mortgages and charges: £3,170.

Insulation Manufacturers, Ltd.—Capital, £10,000 in £1 shares. Return dated December 31st, 1928 (filed October 4th, 1929). Three shares taken up. £3 paid. Mortgages and charges, nil.

Tees Power Station Co., Ltd.—Satisfaction to the extent of £20,000 on various dates from April 1st to November 12th, 1929, of debentures secured by trust deed dated May 7th and registered May 24th, 1918, securing £600,000.

Thomas Wilkinson (Arnside), Ltd.—Satisfaction in full on November 6th, 1929, of debentures and mortgage dated April 7th and registered April 18th, 1922, securing £10,250.

Electrical Enterprise, Ltd.—Debenture dated November 14th, 1929, to secure £6,000, charged on land at Bungay and the company's other property, present and future, including uncalled capital. Holders: Branch Nominees, Ltd Particulars also filed of £2,450 debentures authorised November 13th, 1929, constituting a second floating charge on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Pinnacle Switchgear, Ltd.—J. G. Farquhar, 6, Minorca Road, Weybridge, ceased to act as receiver or manager on November 9th, 1929.

Thomas Hall & Son, Ltd.—Satisfaction in full on November 11th, 1929, of debenture dated July 19th, and registered July 24th, 1928, securing £10,000.

City Notes.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

The annual meeting of this company was held on November 29th. Sir John Ferguson (chairman), who presided, said that with regard to Silvertown, not only had the increase in sales required not materialised, but they had had a much larger drop than had been the case in the previous year, and consequently economies in overhead charges had been more than swallowed up by reason of the lower turnover. The work of erecting the new steam and power plant was well in hand, and there was every indication that they would have the whole of the installation in working order by the beginning of December The total sales showed a decrease of 11.4 per cent. With reference to the outlook for the current year no difficulty was likely to be met in at least equalling last year's general india-rubber figure. In connection with ebonite, a considerable turnover had been lost in consequence of bakelite and other mouldings having come forward, but they were slowly moving ahead, and orders had been secured and were being dealt with. The current year had started under somewhat more promising conditions than had prevailed twelve months ago, the work of a general character awaiting manufacture standing at 11 per cent. higher. Submarine cable work had practically dropped to zero. Regarding the activities of Persan during the year, after two consecutive years of very heavy loss, there had been an improvement within twelve months, equivalent to about £40,000. The year's trading showed a moderate profit, the first for a number of years, and the most substantial since 1920. The main elements in the recovery were that the turnover had increased by more than 12 per cent. and overhead charges had been largely reduced. After a period of relative inactivity in the wires and cables department they had recovered their share of the general market and of special contracts for heavier cables. Up to the present, their sales in the new year had shown a 30 per cent. improvement on the corresponding period a year ago, yet because of a shortage of labour that increased production scarcely kept pace with the growing volume of orders on their books. Plans for new equipment and for more economical re-grouping of existing plant were in hand, and there was every indication of a prosperous year ahead. The report and accounts were adopted.

La Plata Electric Tramways Co., Ltd.

An extraordinary meeting was called for Wednesday last for the purpose of approving a provisional agreement for the sale of the company's undertaking to an Argentine company, La Nacional. This is the outcome of the keen competition between the two concerns. Costly improvements are necessary and in existing circumstances the expenditure would prove unremunerative. The purchase price is £375,000, plus a certain sum for stores on hand. Of this £45,000 is to be paid in cash and the balance, secured by first mortgage 5½ per cent. debentures, will remain on loan for ten years. To meet the arrears of dividend on the La Plata preference shares (amounting to £133,000) it is proposed that the ordinary shareholders shall transfer 60 per cent. of their holdings (£150,000) to the preference shareholders. The sanction of the Court will be required to effect this. To deal with the existing capital loss it is proposed to write down the £1 ordinary shares to 4s., thus reducing the company's capital from £450,000 to £250,000. Other resolutions relating to the compensation of directors, &c., were to be put before the meeting.

Aluminium Corporation, Ltd.

The annual meeting was held recently, Mr. Kenneth M. Clark, J.P. (chairman) presiding. The chairman said that during the year the associated company in Norway had regularly sent forward supplies of metal, and the rolling mills in North Wales had thus been enabled to keep going steadily. As a consequence of the fall in the price of metal, they had not derived as much benefit from the sales agreement with the Norwegian Company as was at one time anticipated. With the opening of the Maentwrog power station of the North Wales Power Co. and the conclusion of an agreement between the Power Co. and the Central Electricity Board for the future supply of electrical energy at a price with which they could not compete, it was decided to dispose of the hydro-electric portion of their undertaking to the Power Company. As a result of this transaction their finances would necessitate reconstruction, and the directors hoped in due course to put forward a scheme for reorganising the capital of the company. The report and accounts were adopted.

Official Notice *re* Companies.

The names of the undermentioned companies will be struck off the Register at the expiration of three months, unless cause is shown to the contrary:—

Chippenham Electric Supply Co., Ltd.
Eureka Electric and Wireless Maintenance Guarantee Co., Ltd.
Hadem Wireless, Ltd
Melksham Electric Supply Co., Ltd.
Midland Electrical Tube Co., Ltd.
Trowbridge Electric Supply Co., Ltd.
Winchcomb Electric Light & Power Co., Ltd.

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Buenos Aires Town and Docks Tramways, Ltd.

Presiding at the annual meeting on November 26th, Mr. B. H. Binder (chairman) said the tramway system comprised about 26½ miles of track, 71 motor tramcars and 22 trailers. The number of passengers carried totalled over 15,500,000, a small decrease of 189,000 as compared with the previous year; there would have been an increase but for the prevalence of labour disputes and competition from jitneys—a type of taxi-cab. The capital expenditure during the year amounted to £10,200, and included the purchase of five new tramcars. The programme of improvements included the provision of ten similar cars during the next 18 months. The report and accounts were adopted.

Stock Exchange Notices.

Dealings in the following have been allowed by the Committee of the Stock Exchange under Rule 159:—

Joseph Lucas.—125,000 ordinary shares of £1 each, fully paid, Nos. 819,301 to 944,300.

Underground Electric Railways Company of London.—2,254 ordinary shares of £1 each, fully paid, Nos. 7,275,068 to 7,277,321.

Radio Corporation of America.

The gross income for the quarter ended September 30th was $63,272,926, as against $23,643,332 in the corresponding period of last year. The surplus for the quarter amounts to $8,729,389, as compared with $5,221,145, raising the surplus for the first nine months of the year from $9,745,924 to $13,725,877.

S. Smith & Sons (Motor Accessories), Ltd.

The profit for the year ended August last was £164,793, against £160,937. The dividends on the preferred and deferred ordinary shares are maintained at 17½ and 37½ per cent., respectively, and the general reserve again receives £28,000. £10,000 is written off patents and £47,368 (against £43,079) is carried forward.

Electric Construction Co., Ltd.

In declaring the interim dividend on the preference shares (3½ per cent.) the directors say that they consider it prudent not to declare an ordinary dividend until the accounts for the full year are available. An interim dividend of 3 per cent. was paid last year.

United Electric Tramways Co. of Caracas, Ltd.

The net revenue to June 30th was £7,843, but owing to a loss of £8,857 on the omnibus system, the directors do not recommend the payment of a dividend. A balance of £53,698, which includes £45,854 brought in, is carried forward.

American Commonwealth Power Corporation.

The gross earnings of the Corporation and affiliated utilities to October 31st, amounted to $23,361,740. After payment of dividends on first and second preferred stocks, there is a balance for reserves, federal taxes and surplus of $3,434,261.

Chloride Electrical Storage Co., Ltd.

A dividend of 10 per cent., free of tax, has been declared on the "A" and "B" ordinary shares for the first half of the year, against 5 per cent. on smaller capital for the corresponding period of last year.

Consolidated Gas, Electric Light, and Power Co. of Baltimore.

A dividend of $0.90 per common share has been declared in respect of the quarter ending December 31st.

Globe Telegraph and Trust Co., Ltd.

Interim dividends of 3s. per share on the preference and 5s. per share, free of tax, on the ordinary shares have been declared.

Cambridge Electric Supply Co., Ltd.

An issue of 140,000 £1 ordinary shares at par is being made. The new shares are being offered in the first place to existing shareholders in proportion to their holdings.

French Companies.

The *Fil Dynamo, S.A.*, earned net profits of 705,000 fr. in 1928-29; the "A" shares receive 36 fr. each and the "B" shares 29.52 fr.

The *Etablissements Paz et Silva, S.A.*, report net profits of 2,138,000 fr. for 1928-29; the dividend is 15 fr. per share, as compared with 12 fr. in the previous year.

The Société Française Radio-Electrique reports a net profit of 3,459,000 fr. for the 18 months ended June 30th last. The dividend is 15 fr. per share.

The net profit of the *Société Electro-Câble* for 1928-29 was 11,670,000 fr The dividends are at the rate of 10 per cent. on the old "A" shares, 5 per cent. on the new "A" shares, 11 per cent. on the "B" shares, 5½ per cent. on the old "C" shares, and 2½ per cent. on the new "C" shares. The distribution is made on a total share capital of 82,500,000 fr. as against 50,000,000 fr. in the previous year.

Burma Electric Supply Co., Ltd.

The net profit for the year ended July 31st last was £13,611, as against £13,995 in the preceding year. The final ordinary dividend is 2½ per cent. making 5 per cent. for the year (against 6 per cent.) and £7,246 is carried forward. The report states that earnings of the tramways have again been seriously depleted by competition from motor-omnibuses.

Atlas Co.

The alteration of the name of the Atlas Light & Power Co., Ltd., to the "Atlas Electric & General Trust, Ltd.," has received official approval.

Stocks and Shares.

TUESDAY EVENING.

STOCK Exchange markets complain of the paucity of business that obtains in all parts of the House, and this neglect on the part of the public has led to a weakening of prices in various popular sections, in spite of the expectation that the Bank Rate may be reduced to 5 per cent. before the end of the year. New York had three days' holiday last week, following three half-days of work, but when the Americans returned to business on the Monday morning of this week, the amount of trade which they found awaiting them did not seem to be anything great. At any rate, it was insufficient to exercise any particular influence over prices. The principal feature in our lists is a general fall amongst Underground Electric Railway issues.

Undergrounds Lower.

The prices of these issues show pronounced flatness, owing to the statement made by Mr. Herbert Morrison, on Monday, night, in the House of Commons, outlining the intention of the Government to excercise control over London transport. Mr. Morrison contended that what is required is "a far-reaching measure of unification under public control," which is a phrase that can be made capable of various interpretations. Until more definite information is given on the subject, nobody can tell what may be going to happen to the companies concerned in the business.

The Stock Exchange effect was a reduction in the price of Underground income bonds by 4 points to 103. The ordinary shares fell 1s. to 21s. 6d., Districts are 10s. lower at 72, and Metropolitans, which had been a good market previously at 62½, on the hope of an increase in the dividend next spring, reacted to 62. The absence of mathematical data proved too much for the market's nerves. So far as the tramway shares are concerned, no quotable alterations have occurred. The only difference is that, instead of the shares being negotiable with a fair amount of ease, the prices are now more or less nominal.

Electricity Supply.

Movements in the market for electricity supply shares have been this week mainly in the upward direction. The principal rise is one of 2s. 6d. secured by Clyde Valley shares, the price rising to 38s. 9d. on buying from the North. The Select Committee of the House of Lords that is charged with consideration of the Grampian Electricity Supply Bill, is making progress with its work Metropolitan Electrics have thrown off part of the weakness which seized them recently, following upon the issue of new shares, and upon fears that earlier American purchasers of the shares would be forced to realise. The price has recovered to 37s. 6d., and the new shares, which a fortnight ago were changing hands at 1s. 6d. premium, are up to 5s. 9d. premium. Midland Counties new shares are also better at 9d. premium buyers. Yorkshire Electric show a rise of 1/16 to 33s. 9d. On the other hand, there are small falls in County of London ordinary at 48s., and in Brompton ordinary at 25s. 6d. Northamptons, at 44s. 6d., are the same as they were a week ago; Egham & Staines remain at 35s. British Light & Power shed the 9d. that they gained, going back to 13s. 9d., and Atlas eased off a little to 27s. 6d.; the preference shares are unchanged at 23s. 6d. Isle of Thanet are steady at 31s. 6d.; the preference, however, have fallen back to 23s. Prices of Australian and of Indian electricity supply shares show practically no alterations on the week.

Plenty of Money.

People who sold electric lighting shares some time ago, and have been carrying them over—"taking them in," is the technical term—find increasing difficulty in continuing these

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loan-accounts from fortnight to fortnight. In other words, there is so much floating money available at the present time that buyers of shares have no difficulty in obtaining whatever accommodation they require. In fact, there is more cash seeking temporary employment than there are stocks and shares open for people who want to borrow money on the security of them. The net result is that, in spite of the season of the year, and the heavy falls which have occurred in prices during the past two months, capital in plenty is to be obtained, and at reasonable rates. The sellers of the electric lighting shares, to whom reference was made in the opening words of this paragraph, are being obliged to deliver their shares, the purchasers electing to take up the latter.

Telegraphs and Telephones.

Disappointment has befallen the holders of Cables & Wireless issues, the sharp improvement of a week ago proving to be no more than a flash in the pan, and being followed by a fall of 5 points in the company's "B" ordinary stock. This has reduced the price to 40½, comparing with 35 and 102 as the lowest and highest, respectively, of the current year. "A" ordinary has gone back 2 points to 79½. Estimates of a probable 5 per cent. dividend on this stock, in respect of the first year's working of the combine, are being modified downwards, and cautious people now profess that they will be satisfied if the dividend is 4 per cent. The full rate to which the stock is entitled is, of course, 7½ per cent. The likelihood of this being secured within the next year or so must depend upon the accession of business and reduction in expenses that, it is hoped, will follow the amalgamation of the Eastern cable companies, Marconi's, and the beam system. Marconi Marines are ½ better at 46s. 3d. Baird Televisions strengthened to 6s., on the B.B.C. giving increased facilities for the development of the company's invention. Indo-Europeans are unchanged at 52½. Anglo-American stocks are steady. Amongst telephones, no particular change has occurred. Anglo-Portuguese are 1 1/16. Cuba Telephone 5 per cent. bonds drooped to 92½.

Dollar Stocks.

Upon Wall Street's resumption of business early this week, the Americans, as already mentioned, appeared to be content to take things quietly, and there have been no fireworks in any of the leading specialities. Hydro-Electrics have moved fairly rapidly, going to 41½ before the price reacted to 36½, the latter showing a fall of 2 points on the week. A similar decline befell American Telephone & Telegraph stock at 228. International Telephone & Telegraph, at 73, is 3 lower. Talk of possibility that the Brazilian Traction, Light & Power Company may increase its quarterly dividend—the present rate is 2 per cent. per annum—led to demand for the shares, and, after dropping to 40, the price rallied to 42, which shows a fall of 1½. The preference shares, at 140, have parted from 10 of the 20 points that the price gained a week ago. Montreal Light & Power, at 120½, is the fraction better, and Shawinigan, at 78½, show a fall of 3½. Pennsylvania Water & Power, at 74½ are 8 lower. It is announced that the previously-projected schemes for hydro-electric development in Canada are to come into being as soon as the time is propitious. British Columbia has a programme involving the expenditure of 22 million pounds sterling, to be spread over the next half-decade, and estimates are made of the necessity for spending an equal amount in enterprises to consume the additional electrical output. The two companies chiefly concerned at present are the British Columbia Power Corporation and the West Kootenay Power and Light Company.

Mexicans are somewhat irregular. The 5 per cent. bonds of the Tramways Company are up 7½ to 72½, but Mexican Light & Power issues exhibit a dull tendency. The firsts and seconds have each shed 2, at 75½ and 69, respectively.

The Manufacturing Group.

Callender's Share & Investment Trust reports a net profit for the past year of £37,200, being an increase of nearly £10,000, and the dividend is to be 20 per cent., less tax, against 15 per cent. in the preceding year. The price of the company's 5 per cent. debenture stock is 96½. Callender's ordinary shares at 3¾ have risen ¼. Henleys retain their substantial gain at 5½, and the other members of the manufacturing group keep very firm. Siemens 10 per cent. preference shares, which are not always readily obtainable, can be bought, at the time of writing, to the extent of several thousands at 33s., this offering a return on the money of £6 1s. 3d. per cent. without taking into account the accrued dividend due next month. The ordinary shares remain at 26s. 3d. Electric Construction shares, although quoted at 15s. middle, have changed hands at 12s. 6d., and British Electric Transformer preference, nominally 13s., were sold a few days ago at 11s. 3d. Associated Electrical Industries ordinary shares, from 30s., eased off to 28s. 9d. General Electrics, however, retain their previous improvement at 46s. 3d. Telephone Manufacturing ordinary are 4s. 3d., International Automatic Telephone ordinary are 36s. 3d., and the latter company's "B" deferred shares stand at 35s. It will be observed that the price of the Victoria Falls ordinary shares has been added to our price lists this week.

Babcock & Wilcox shaded off to 62s., while Vickers remained tolerably steady at 7s. 9d. Rubber shares are dull, on the price of the produce having receded to a trifle under 8d. per lb.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom.	Approx. Dividend. 1927.	1928.	Price Dec. 3 1929.	Rise or fall	Yield p.a.
	£					
Bournemouth and Poole	1	15	15	58/9	—	5 2 0
Brompton Ordinary	1	8½	8½	25/6	−6d.	5 9 10
Charing Cross Ordinary	1	8½	8½	26/6	—	5 5 0
do. do. 4½% Pref. ...	1	4½	4½	17/-	—	5 6 0
Chelsea	1	8¼	8¼	25/-	—	5 12 0
City of London	1	10	10	39/-	—	4 7 8
do. do. 6% Pref.... ...	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	1 1 5/16	+1/16	... ...
County of London	1	7	10	48/-	+9d.	4 3 4
do. do. 6% Pref.... ...	1	6	6	22/6	—	5 6 8
Edmundson's 7% Pref.	1	7	7	24/-	—	5 16 8
Elec. Supply Corporation	1	11	11	48/3	—	4 11 ...
Kensington Ordinary	1	8	8	26/-	—	5 7 8
Lancs. Light and Power	1	7½	7½	27/-	—	5 11 2
London Electric	1	8½	9	27/-	—	5 1 10
Metropolitan	1	9	9	37/6	+1/16	4 16 0
do. 4½% Pref.	1	4½	4½	17/-	—	5 6 0
Midland Counties	1	6½	6½	28/-	+6d.	4 13 10
Mid. Elec. Power	1	15	8	33/9	—	4 14 10
Newcastle-on-Tyne Ordinary ...	1	6	6	23/9	—	5 1 1
do. 7% Pref.	1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	10	6	6	11	—	5 9 1
North Met. Elec. 6% Pref. ...	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	1	8	8	26/-	—	5 7 8
Scottish Power	1	8	8	29/-	—	5 13 8
South London	1	8½	8½	25/6	—	5 9 10
Urban Ordinary	1	7	7	35/-	—	4 0 0
Westminster Ordinary	1	8½	8½	25/-	—	5 12 0
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	23/6	—	6 7 8
Yorkshire Elec.	1	8	8	33/9	+1/16	4 14 10

HOME RAILS.

Central London Ord. Assented ...	Stock	4	4	71	—	5 12 8
Metropolitan	"	8	8½	61½	—	5 18 10
do. District	"	4	5	72	−½	6 19 0
Underground Electric	£1	5	7	31/6	−1/-	6 10 8
do. do. Income ...	Bonds	6	6	103	−4	5 16 6

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	99½	—	6 0 7
do. Def.	"	1½	1½	24½	—	6 4 5
Automatic Telephone	1	10	12½	37/6	—	6 13 4
Cables & Wireless 5½ Pref.	Stock	—	—	96	−½	5 14 7
do. A 7½ Ord.	"	—	—	79½	−2	... ...
do. B Ord.	"	—	—	40½	−5	... ...
Globe Tel. and T. Ord.	10	10	10	23	—	*4 7 0
do. do. Pref.	10	6	6	10⅝	—	5 9 1
Great Northern Tel.	10	20	17½	29	—	6 0 9
Indo-European	25	10	10	52½	—	*3 16 9
Marconi-Marine	1	12½	15	2 1/16	+⅛	... ...
Oriental Telephone Ord	1	12	12	2 1/16	—	... ...

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	8⅜	+1/16	8 15 0
do. do. 2nd Pref. ...	5	6	6	8 1/16	—	9 15 0
do. do. 5% Deb. ...	Stock	5	5	72½	—	6 18 0
British Electric Traction Def. Ord.	"	5	5	1425	+25	... ...
do. do. Pref. Ord.	"	8	8	120	—	6 13 4
Brazil Traction	100	7	8	42	−1½	4 15 8
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	87½	—	5 14 8
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	9/6	+6d.	... ...
London United Tram Deb. ...	Stock	4	4	51½	—	7 15 4
Mexico Trams, 5% Bonds	—	5	5	72½	+7½	6 18 0
Mexican Light Common	100	Nil	Nil	75	—	... ...
do. 7% Pref.	100	7	7	77½	—	9 0 8
do. 1st Bonds	—	5	5	75½	−2	6 13 5
Yorkshire (West Riding)		Nil	Nil	5/-	—	... ...

MANUFACTURING COMPANIES.

Assoc. Elec. Ord.	1	6	—	1 7/16	−1/16	4 3 4
Babcock & Wilcox	1	18	15	62/-	−6d.	*4 16 9
British Aluminium Ord.	1	10	10	46/-	—	*4 7 0
British Elec. Transformer Pref. ...	1	7	7	18/-	—	... ...
British Insulated Ord.	1	15	15	3¾	—	4 0 0
Brush Ord.	Stock	10	10	126½	—	7 18 1
Callenders	1	15	15	3¾	+⅛	4 0 0
do. 6½% Pref.	1	6½	6½	1¼	—	5 4 0
Crompton Parkinson Ord.	5/-	—	80	20/-	—	7 10 0
do. 8% Pref.	1	8	8	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	7 1 9
do. 5% Deb.	Stock	5	5	84½	—	5 18 4
Electric Construction	1	7½	5½	15/-	—	7 6 8
Enfield Cable Ord.	1	20	20	4⅝	—	4 2 0
English Electric	1	Nil	Nil	6/3	—	... ...
do. do. Pref.	1	8	Nil	8/9	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
do. Ord.	1	10	10	2 1/16	—	4 6 7
Henley...	1	25	30	5⅝	—	5 2 0
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	Nil	Nil	11/3	—	... ...
Johnson & Phillips	1	10	—	36/3	—	5 10 8
Siemens Ord.	1	7½	7½	26/3	—	5 14 8
Telegraph Construction	12	10	10	23	—	5 4 8
Victoria Falls Ord.	1	15	15	2⅞	—	5 4 8

* Dividends paid free of Income Tax.

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The B.E.A.M.A.

A Comprehensive Industrial Survey.

(*Concluded from page* 966.)

Prices and Profits.

International competitive efficiency is next dealt with, and it is shown that, allowing for a difference in wages, taxation, and a strict adherence to the 48-hour week, British selling prices would require to be 20 per cent. above the German, 2.5 per cent. above the Swiss, almost 40 per cent. above the French, and 50 per cent. above the Belgian, before the British manufacturer could hope to earn the same ratio of profit. In spite of these facts, the industry is not only meeting competition, but is actually increasing its hold, thanks to efficiency of manufacture and the technical changes which have favoured quality as against mass production.

An examination of the financial returns of thirteen firms covering 90 per cent. of the output of electrical and allied machinery is next given, and shows very clearly the results of the severe competition which has been met, and the narrowness of the margins by which success has been achieved. In four years these firms showed on the aggregate an increase in volume of output of 67 per cent., an increase in labour of 38 per cent., an increase in turnover of 2 per cent., and a decrease in net return of 18 per cent. Had no compensating factors been in existence such results would have meant little short of bankruptcy, but thanks to the improvements already referred to and a general re-organisation of the type now known as "rationalisation," all these firms have managed to win through. At the same time the financial position is far from satisfactory. The returns have become so low that there is a danger of losing those liquid financial resources which are necessary to handle large contracts, to say nothing of the expenditure required for research and development which is essential if a lead is to be maintained. The memorandum also suggests that Stock Exchange quotations for these firms' shares are not a reliable guide as to their prosperity, and represent at the moment about double the yield that is actually being obtained.

Export Trade Not Unsatisfactory.

In the section dealing with exports the vexed question of different prices in the home and foreign market is very fully dealt with. One reason given for the check in British exports generally since the war is that our foreign investments have been both lessened and changed in character, from investments giving control, and therefore influencing British purchases, to bonds and debenture issues and short-term credits carrying no control. Nevertheless, thanks to the enormous demand for electrical goods throughout the world and to the lead established in quality goods, our electrical exports increased by 130 per cent. between 1913 and 1928 (8.1 to 18.6 millions sterling) for a period during which the total world export of all electrical goods exactly doubled (37.5 to 75 million sterling). Making a rough division into machinery and apparatus, the latter has shown a much smaller increase than the former, due to the prevalence of mass production methods and low wage rates amongst our competitors. A detailed examination shows this still better, and brings out the quite spectacular increases in such things as switchgear and transformers (2½ times in 7 years).

A Study of Markets.

A territorial study then follows. Australia is now the most important British market for electrical goods, with India a close second, taking totals of approximately 3 million sterling per annum each. Next on the list come Argentina, South Africa, and New Zealand, with totals of from 1 to 1½ millions each. Dealing with our place among other exporters, a list is given of the five principal exporters of electrical goods from 1913 to 1928. Within this period Great Britain's total has risen from 23.4 to 27.4 per cent. of the total exports. Since 1924 there have been no spectacular changes and the three principal exporters, Great Britain, United States, and Germany, have each contributed something like 30 per cent. of the total.

A feature of recent years has been the recovery of Europe which is now the world's best market for electrical manufactures. Unfortunately for this country, most of the increase has been secured by the United States and Germany. In America's case this has been largely the result of financial penetration, as represented by investment in public utilities accompanied by control, and of the establishment of closer relations between American manufacturing firms and European subsidiaries. To a large extent, however, the increased trade which has been secured by these two countries has consisted of telegraphic apparatus, cables, and small mass-production items which are outside the particular aptness and interests of the British manufacturer. Outside the European market, America appears to be our chief competitor rather than Germany, and a detailed analysis of this competition is given.

The Effects of Reparations.

With regard to the increase in German trade in Europe, this is attributable largely to reparations. The reparations story forms an almost fantastic picture of the hollowness of victory and the folly of "making Germany pay." In order to pay her full reparations bill without dissipation of fixed capital and collapse of the mark, Germany would need to become the most prosperous and active industrial country in the world, with a steadily increasing export trade and with industries superior in efficiency and marketing success to those of all other nations. By paying partly in kind, as she is at present, she receives an enormous fillip to her export trade and gains an entry into markets which were at one time closed to her. Usually deliveries in kind are exported free of import duties on the part of the reparations country, or these duties are so reduced that they constitute a premium on German exports in competition with British or American. Moreover, although the deliveries on reparations account in 1929 amounted to only £2.2 millions, out of a total German export of nearly 23 millions, there is reason to believe that in many cases the equipment of a complete power station or line electrification was given to Germany merely because a small portion of the plant was on the reparations account. Chapter and verse for these statements are given in the memorandum.

The Importance of Exports.

Summing up the position it appears that British competitive position in every market was strong before the war; it was almost destroyed by the war and the process of recovery has been very slow in a number of markets. The comparatively strong position it now occupies has been reached only against the strongest competition and with the narrowest of margins, and feelings for the future may be described as doubt tinged with a kind of desperate optimism. Moreover, in electrical engineering this country depends to a greater extent than any other except Sweden upon her export trade, since exports accounted for 22 per cent. of our total electrical production, or 33 per cent. of the production excluding apparatus. The corresponding figures for the other chief countries are: United States, 5.6 per cent., Germany, 16.3 per cent., Italy and France, 12 to 15 per cent., Sweden, 50 per cent. Thus Sweden, alone of all these, has a higher export percentage than Great Britain, this being due to the restricted nature of the Swedish market.

The most hopeful possibilities would appear to lie in the development of new markets. The world in general outside of Europe, the United States, and the Dominions, has hardly yet begun to be electrified, and in this comparative stagnation lies the great opportunity of the British electrical manufacturer. South America, Asia, and Africa are awaiting the expenditure of new capital on essential development schemes, and it is for the British manufacturer, through power finance, Trade Facilities Act, or other mechanism, to supply that capital and initiative in opening up these markets.

The Growth of Electricity Supply.

Dealing with electricity supply as a market for electrical plant, the 1924 census showed that of the total prime movers in the country 53 per cent. were employed in the generation of electricity. This is admittedly a disappointing proportion, but it must be remembered that purely mechanical power had a long start. Thus in the period 1912-1924 the horse-power devoted to electricity generation increased by a greater amount than did the total horse-power of all prime movers, showing that electricity generation accounted for the whole of the growth in this period and even encroached slightly on other forms of power. By 1928 the electrical generating plant had risen to 59 per cent. of the total power production, a figure which still compares badly with that of the United States in which the proportion is approximately 78 per cent. In fact, even at our present rate of growth it will take us 14 years to reach the proportion now obtaining in America.

Of the power spent in generation in 1924, approximately 60 per cent. was for public supply, the other main groups being mines and quarries (13 per cent.) and iron and shipbuilding (10 per cent.) The rate of increase of generating plant has been of the order of 12 per cent. per annum, the line of increase having been practically straight in recent years. In parallel with this growth the country has seen a double revolution in the conversion to electricity as the main source of power, and the almost complete conversion to turbines as the form of prime mover. The motive for both changes has been increased efficiency, and both are almost entirely post-war developments. Thus the increase from 1907 to 1912 was only one million kW, and from 1912 to 1920 only 2 million kW, in spite of war activity and active Government encouragement, whilst the increase from 1920 to 1928 has been nearly 4 million kW.

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The total growth of public supply from 1922-1928 can be expressed as an increase of four times in capacity and rather less than four times in output. This, although good so far as it goes, does not carry us even measurably near saturation, since America, who was admittedly in front of us in 1912, managed in the same period to quadruple her capacity and quintuple her output. The increase in electricity supply has been almost entirely in the sphere of public undertakings, private supplies having been practically stationary. The latter, however, still account for approximately one-third of the total as compared with one-sixth in the United States. The advantage which America enjoys in the home market for large power plant due to her rapid growth in supply stations, is shown by the fact that even with her heavy degree of electrification she installs fresh plant at the rate of over 2.5 million kW per annum, as compared with 0.65 to 0.75 million kW in Great Britain, and 0.75 to 0.85 million in Germany.

Industrial Electrification Possibilities.

A detailed examination is next made of the degree of electrification in different industries, and the total shows a proportion of something like 51 per cent. in Great Britain, as compared with 67 per cent. in Germany, and 73 per cent. in the United States. The differences are attributed not so much to trade depression in this country as to the deliberate load-building policies of American supply undertakings and the extensive rationalisation schemes in Germany. A very interesting table gives the leeway which has to be made up in various industries before satisfactory degrees of electrification are reached. This is expressed in the form of motor horse-power and totals about 5 million in all. The largest deficiencies appear to be in iron and steel (represented largely by the retention of reciprocating engines for rolling mill drive), in cotton (resulting from the predominance of the small undertaking with limited capital), and coal-mining, although in the last case the deficit has partly been made up since the 1924 Census figures. It will be seen that the electrical manufacturer has the very closest interest in anything which will bring back prosperity to these three depressed industries.

The next section covers an interesting world power survey and gives a detailed comparison between the chief industrial nations. The section concludes with a forecast of the growth in electrical demand which may reasonably be expected in the next twelve years from the different groups of consumers. As regards both railway electrification and the electrification of rural industries within this period the memorandum is frankly pessimistic. The final estimate for 1940 is 23,000 million kWh from public supply, and 5,500 million kWh from private industrial plant, as compared with the total of 10,400 million from all sources in 1923-24. At this point a degree of something like saturation would exist on the basis of the present structure and magnitude of industry. But industry itself can be expected both to expand and to become more complex. Fresh uses for electricity are continually emerging, and it is difficult to put any limit to potentialities. There is no reason why the country's output should not exceed 50,000 million kWh in the future rather than the 28,000 million kWh suggested as a preliminary saturation point.

The Electrical Future.

A chapter on the re-organisation of electricity supply deals with the background, both historical and geographical, and the stimulation of demand by supply authorities and development associations, whether carried out locally as in this country or by big national "pushes" as in the United States. The work of the Electricity Commission is then reviewed. The estimated reduction in the price of electricity, excluding distribution as a result of national schemes, is from 0.67d. to 0.4d. per kWh, and the total capital expenditure by 1941 is estimated at £100 million. Adding to this the expenditure by individual undertakings and on distribution plant, consumers' apparatus, &c., it is estimated that an annual sale of 80 million pounds' worth of electrical plant and apparatus should be guaranteed for the next twelve years or so. This total, however, should be more like £120 to £150 millions a year if a genuinely national movement towards electrification is to take place, and the problem is to stimulate the demand so that the consumption will justify the expenditure, and make the national system function to capacity.

The encouragement and possibilities of future electrification are next dealt with. It is claimed that it is not sufficient for the price of electricity to be brought down: capital is also needed to carry out the change, and where necessary there should be provision of capital at low rates with State guarantee. Many of the basic industries, which are only just covering essential debenture and loan charges and have no financial margins whatever, obtain credit with difficulty and are too occupied with self-preservation to have any energy for expansion. Nevertheless a process of reorganisation and rationalisation is already under way, and in a very short time a number of the power consuming industries will be in a position to embark on large modernisation schemes. This period of revival and reorganisation should coincide almost exactly with the completion of the main transmission system projected by the Central Electricity Board, and the latter should therefore be in a position to contribute towards the rapid electrification of those industries. Other much-needed improvements which would contribute to the same end lie in the electrification of railways, docks and other transport facilities, of agriculture, of village industries, and in a greater use of electricity for commercial and domestic purposes. In each of these cases statistical comparisons are made with practice abroad, and figures are given of the increased consumption which might be expected to result. The effect of foreign investments and the operation of the Trade Facilities Acts is also considered, and the necessity for State-aided centralised research is emphasised.

A final chapter deals with the future in a somewhat more philosophical manner. The aspects dealt with include the trustification of industry and the most efficient size of a manufacturing undertaking, the effect of deflation and the functions of economic research in industry. A great possibility is sketched out for the future of the Electricity Board as an index to the country's whole production and as a guide to, and director of, future developments of trade. There are three appendices dealing respectively with "International Electrical Export Statistics"; "Power Finance and Imperial Preference: the Example of Canada"; and "The Dominions as Markets for British Electrical Products." The last of these is fully illustrated with diagrams. It is safe to prophesy that the monograph will be a mine of invaluable statistical material for many years to come, and the whole industry is certainly to be congratulated very heartily upon its production.

Selling British Goods Overseas.

Notes on the Interim Report of the Committee on Education for Salesmanship.

THE Committee on Education for Salesmanship appointed by the last President of the Board of Education, under the chairmanship of Mr. F. W. Goodenough, C.B.E., has published an interim report (Stationery Office, 4d. net). This takes the form of a study of the essentials to success in selling British goods in overseas markets. Taking a broad view of its terms of reference, the Committee asserts that education for salesmanship is education for commerce on its creative, organising and executive sides, and covers the whole field of higher education. The question of overseas marketing was given first place, and considerable assistance has been afforded by the Department of Overseas Trade and the Chamber of Commerce organisations.

While it is agreed that many British firms have reached a high plane of salesmanship, it has become necessary to raise the average level. It has been said that it is bad policy to expose our deficiencies to the world, but concealment is considered even more damaging to British prestige.

The modern world presents a picture of intensified competition, for which the principal reason is the desire and capacity of nations who were dependent on others before the war, to produce what they require themselves; this has been accentuated by growing national consciousness—a desire to support home industries. The increased productive power of the United States is quoted as another important factor. The evidence showed that our foreign competitors, on the whole, have adopted very efficient selling methods in many markets. One result of competition is a wider range of choice for the buyer, which leads him to demand exactly what he wants. The effects of the war have led to a keener appreciation of low prices as against quality, which has militated against British products. British marketing methods appear to be too individualistic, and combination would probably lead to greater success. It is clear that not only is British quality appreciated, but British integrity has led to a definite preference for British goods in many directions.

The Committee takes the view that anybody who is concerned with the marketing side of the business, or is in a position to influence the satisfaction of the customer, is a "salesman." It is considered that employers should make better use of the first-class salesmanship material available. As for the actual salesman, he should possess the attributes of integrity, fortitude, patience, enthusiasm and courtesy. That elusive quality "personality" is also essential. An understanding of the customs and events of the country to which he is sent is very desirable.

It appears from the evidence that a good general education is preferable to specialisation for boys desiring to enter commercial life. This represents, broadly, at least a good secondary education or its equivalent, or, for some markets, a University training. It is always desirable and often essential for a salesman to have a good knowledge of the language

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of his market; a special inquiry is being made into this subject by the Board of Education. Before a salesman is sent to a market, as well as while he is there, he must devote his energies to a study of that market. He should have a good general geographical knowledge, and it has been suggested that he might spend some time in the country concerned before definitely taking up his duties there. Similarly, firms should study market conditions primarily to discover whether success is probable; a preliminary visit should be paid by a principal or responsible representative of the firm. Another matter, which is taken for granted, is that a salesman should have a thorough knowledge of the goods which he sells. It is necessary for the pay and prospects (or status) of a salesman to be given consideration; salesmanship should not be considered "a minor sort of occupation." Again, the salesman overseas should be afforded the fullest support, and his reports should be given serious consideration.

A chapter is devoted to "Some Essentials of Successful Marketing Overseas." The importance of personal touch between the principals of a firm and its customers is again stressed, especially in markets in which agents are employed. The necessity for taking every possible step to meet customers' requirements is reiterated, and special reference is made to low-priced goods. Although the Committee deprecates any idea of a general lowering of British quality, the evidence of some witnesses suggests the possibility of considerable trade expansion in certain directions by this means. A tendency on the part of British exporters to delay delivery and correspondence is condemned. It is pointed out that strong and heavy packing is not always desirable, as Customs duties are often calculated on gross weight, and heavy packing adds to transport costs. It is necessary for an exporting firm to have a thorough knowledge of the trade regulations, Consular formalities, tariffs, &c., of various countries; information of this nature can be obtained from the Department of Overseas Trade. Not only should catalogues be printed in the language of the country for which they are intended, but in all transactions the currency, weights and measures of the country concerned should be employed. "No trouble" quotations are to be desired, giving the actual cost to the inquirer rather than the "f.o.b." price. The thorny question of credit is given consideration. It is said that, generally, the terms of foreign competitors are more favourable, and those concerned are urged to give the matter their closest attention. Another matter in which foreign competitors are said to lead frequently is "service," and the importance of customers being able to secure advice and spares "on the spot" is stressed. On the subject of the employment of agents, it is maintained that where an agency is necessary a certain amount of personal supervision should be exercised, although the agent should not be unduly restricted. This personal acquaintance should, if possible, precede any appointment; the engagement of natives of the country concerned is recommended. An agent should be offered reasonable terms if he is to be expected to take an interest in his work. A better use should be made of the publicity methods available, such as the Press, window displays, street hoardings, &c., and the Committee draws attention to the good results which may be obtained from participation in exhibitions. The evidence appeared to show that the means available for obtaining information (*e.g.*, the Department of Overseas Trade and Chambers of Commerce) are not sufficiently used.

In its conclusions the Committee considers that the outstanding weakness in British marketing overseas is "A detached and insular attitude and unscientific practice—relics of the time, long past, when we enjoyed a virtual monopoly of the world's markets for manufactured goods. For this weakness (again very broadly) the remedy is mainly to be found in a policy based on the most searching study of the character and needs of the market; on close, continuous and sympathetic contact with it, and on the guiding principle that the complete satisfaction of the customer is the basis of all permanent commercial prosperity."

Alternator Voltage Control.

Generator and exciter stability, and speed of response to control, under transient load conditions, with special reference to the large high-speed machines now being installed in capital stations.

By H. W. TAYLOR, M.I.E.E.

(*Extracts from a paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE problem of maintaining constant the voltage of a generator when large loads are frequently thrown on and off it is still met with in some mills and factories which, for good reasons, continue to generate their own power.

With power supplied from capital stations and the increasing size of systems, incidental variations in legitimate load have become relatively small, and only system faults constitute changes of load which require adjustment of the machine excitation.

As systems expand they are sectionalised, with interconnecting reactors between sections. When a severe fault occurs close to the generating machinery in one section it is unlikely that any practical design, or mode of operation, can maintain full voltage. Indeed, there is a difference of opinion among operating engineers on whether the excitation of the machines should be allowed to increase appreciably under these conditions. When, however, a fault occurs at a distant point, or in an adjacent section, it is usually desired to increase the excitation of the generators quickly to the limit of the exciter capacity, so as to maintain the supply voltage as near to normal as possible, at any rate on those sections of the system which are not local to the fault.

The magnet systems of large machines require larger stores of electromagnetic energy, which tends to lengthen the time needed to respond to changes in excitation intended to maintain normal voltage after sudden load changes.

Stability determines whether the drop or rise in voltage becomes cumulative after certain load-changes, and response determines the quickness with which, by a change of excitation, voltage can be restored when temporarily disturbed by load-changes.

Voltage control is nowadays required to be automatic within a few per cent. of the normal value, and the author's consideration of the subject is simplified by discussing, first, the exciter alone; secondly, the generator alone, and, finally, the two in combination as a generating unit.

The paper may be considered somewhat incomplete, inasmuch as it does not deal with the conditions which arise when the alternator is operating in association with other plant. Its object is to preach the gospel of the separately-excited (stabilised) exciter, improved by super-excitation, as compared with a shunt exciter. The last-named is slower than the separately-excited machine in voltage growth and response, as it depends for its exciting current upon its own voltage, which, at time of light load, is of relatively low value, whereas the separately-excited machine has always a high steady voltage with which to effect changes in exciter excitation. In order to make separate excitation of the exciter acceptable the practice has been initiated of building, as an integral part of the machine, a small service exciter which operates at constant voltage with a saturated magnetic circuit, and is, therefore, perfectly stable for exciting the main exciter. A neat arrangement consists of combining the service exciter in the same frame as the main exciter.

If an alternator is connected to a circuit which consists largely of capacity, *e.g.*, unloaded long overhead lines or underground cables, it may be self-exciting, owing to leading current in the stator windings acting as a magnetising current upon the magnetic circuit. The alternator will be inherently unstable in that the voltage may rise to a value which will be limited only by saturation, as sometimes occurs in high-potential testing when a smaller alternator is used to provide current for testing a large stator. On commercial circuits the effect has been noticed in some installations abroad, but it is not likely to be as troublesome in England, as (even when the country is linked together in one distribution network) the charging current will be small, compared with the load current, which will contain a lagging as well as a power component. However, it is suggested that operating engineers, when specifying power factor for their machines, should include the capacity current required in distribution, and that manufacturers should base the stator dimensions upon kW rather than kVA rating, and should use longer air-gaps when high power factors are specified.

Voltage regulators operate upon the exciter field circuit rather than directly upon the alternator field circuit, because it is not practicable to manipulate contacts carrying the large exciting currents of the latter. So soon as an increase in load causes an appreciable voltage-drop the regulator should short-circuit the exciter field rheostat, and continue to do so until normal alternator voltage is restored. In combination, the response of the alternator waits upon the response of the exciter, and an accumulative delay occurs in the restoration of the normal alternator voltage.

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In calculating the combined response it is sufficiently accurate to take the average exciter response in terms of alternator voltage in the given change in load, and to associate it with the alternator time-constant for the new load; by this means, upon a change in load and with the exciter rheostat short-circuited, a curve of rising voltage can be plotted on the supposition that the increased alternator reaction for the new load is not effective. Three such curves can be derived; one for a shunt exciter, the second is for the same exciter separately excited, while the third is for super-excitation of the same machine at twice the exciter voltage. We thus calculate (1) the drop in voltage due to armature reaction when the exciter does not respond, and (2) the rise in alternator voltage due to the exciter if armature reaction were not effective.

We assume that the actual cycle of voltage variation after a change in load is the addition of the rise on the one curve to the fall on the other. Such average curves show a maximum voltage drop of 8 per cent. and a time of 3.8 sec. to restore the voltage completely to normal again in the case of the shunt exciter; for separate excitation the figures are 5.5 per cent. voltage-drop and 1.8 sec. for restoration, and for super-excitation 4.5 per cent. drop and 1.0 sec.

The vibrating-contact type of regulator provides for different exciter voltage at different loads by allowing its contacts to remain closed for a relatively long time at high loads and a relatively short time at low loads. For such a gradual increase in load as does not cause much alternator voltage variation the change in the character of the beat (that is, to a longer period of junction of the contacts with a shorter time of break between periods of contact) is also gradual and the average value of alternator field current increases with the load. With sudden increase in load and wider variation in voltage it is necessary that the regulator should temporarily short-circuit the exciter field as soon as possible after load is thrown on, which is effected in the vibrating-contact type by a cessation in the beating of the contacts. Any hesitation in the regulator in doing this will appreciably lengthen the time before voltage is restored and appreciably increase the maximum voltage-drop which will occur during this period. Again, because of the lagging of the alternator response behind the exciter response, the exciter voltage will temporarily overshoot the value required for the new load, but so soon as the alternator voltage is restored the regulator should commence beating in a suitable manner for the new load.

Discussion in London.

Four speakers only took part in the discussion, which fact prompted the chairman (Capt. J. M. Donaldson) to ask the author not to measure the meeting's appreciation of the paper by the length of the discussion. The paper was considered opportune in view of the policy of inter-linking now being carried out, and general agreement was expressed with the author's conclusions. Modifications of exciter system were mentioned with the object of imparting residual magnetism in order to improve stability and quicken response. A more precise definition of stability was needed to enable it to be measured from exciter saturation curves. The energy aspect should be kept in mind rather than that of voltage. To the advantages claimed by the author should be added that of altered outlook, for regulation was nowadays so good that it mattered little, and reactance assumed much more importance from the short-circuit point of view. In America to-day 200,000 kW was considered to be the limit of size of machine.

Electrical Trades' Benevolent Institution.

Annual Festival Dinner.

As was reported in our last issue, the annual dinner of the Electrical Trades Benevolent Institution was held at the Savoy Hotel, London, on November 26th. About 250 members and guests assembled under the festival presidency of Mr. Howard Marryat, M.I.E.E., M.I.Mech.E. The function amply achieved its dual purpose of incrementing the funds needed by the Institution for the pursuance of its laudable objective and of providing a pleasant social evening for those having at heart the alleviation of misfortune that has befallen men who have served a great industry.

Mr. H. MARRYAT, after the honouring the loyal toast, proposed the health of "The Electrical Trades Benevolent Institution." He appealed to manufacturers, wholesalers, contractors, and those undertaking the generation and distribution of electricity to provide the income necessary for the proper carrying on of the Institution's work. The electrical industry was the one bright spot in a period of bad trade. The funds in hand at the beginning of the year amounted to only £37,000, which had taken about 23 years to accumulate. This figure was less than many industries paid out annually in benefits. The minimum figure with which they could face their responsibilities for the future with security was £50,000. There must be many casualties in a big industry such as theirs. A helping hand in time had enabled many who had been in difficulties to occupy once again an honourable position. No cases of genuine distress had been left unrelieved, but the calls on the Institution's resources were increasing. Those suffering from incurable disease should be pensioned. It was proposed to broaden the basis of the financial position by seeking for contributions from the class most likely to benefit. The committee and the secretary, Capt. J. T. Keeping, had done splendid work for the Institution.

Mr. JUSTUS ECK, acting chairman of the executive committee, asked Mr. F. B. O. Hawes to accept from the committee, on the occasion of his retirement after 19 years' service from the position of honorary secretary, a suitably engraved seven-valve wireless set. Mrs. Hawes was also presented with a silver bowl and a leather case containing a series of appreciative letters. Mr. Eck, after extolling the devotion of Mr. Hawes to the work of the Institution, and touching upon his inventive capacity, read a letter from the chairman of the executive committee, Mr. E. A. Gatehouse, whose absence was occasioned by illness. The letter referred to the enormous debt owed by the whole of the electrical industry to Mr. Hawes for his hard work, of which only those who had worked with him could be fully aware.

Mr. F. B. O. HAWES, after expressing his thanks, said he hoped that the broader basis upon which it had been proposed to finance the Institution would not, by offering the inducements of benefits, cause it to become a "friendly society." While welcoming small contributions, they should also endeavour to obtain large individual donations; this would not be realised unless all contributions were voluntary.

Mr. LL. B. ATKINSON, in proposing the health of the President, paid a warm tribute to Mr. Marryat's courage and cheerfulness, and described him as "a getter of things done," and a man of many parts and hobbies, possessed of proper proportions of brains and brawn.

Mr. W. R. RAWLINGS, seconding the toast, said that Mr. Marryat had done more than any other man for electrical contractors, and that his reward was in benefitting those unable to help themselves.

After the president had responded, the company adjourned to the ball-room, where dancing continued until 2 a.m., with an interval for the auctioning of a seascape picture in aid of the funds. Mr. C. L. Arnold was the purchaser for £26 5s., and had the privilege of raising the total sum collected since the last festival dinner to a round £9,000—an amount considerably exceeding previous records. Due credit must be given to the secretary, Capt. J. T. Keeping, for his share in obtaining this fine result. Subsequent donations, we understand, have increased this figure still further. The thoughtful provision of blank cheques on the dinner table was responsible for bringing in no less than £925. The totals of the collectors' lists were as follows:—

	£ s. d.	£ s. d.
H. Marryat:—		
Personal	5,286 2 0	
per L. C. Penwill ...	72 1 11	
per E.C.A.	624 10 3	5,982 14 2
A. G. Beaver		16 16 0
C. H. Cox		81 15 0
"Distribution"		79 9 6
J. Y. Fletcher		546 2 9
Miss C. Haslett		18 5 6
H. Howitt		280 15 6
W. R. Rawlings		158 2 6
Major W. Roberts		17 13 4
E. E. Sharp		11 0 6
J. M. Sim		40 14 0
J. N. Stephens		218 16 9
L. Thurner		128 16 6
C. Wilson		184 19 6
E. Wilson		243 8 6
		£8,009 10 0
Dinner collection		925 0 0
	Total	£8,934 0 0

Included in the above were the following donations:—Mr. Dane Sinclair, £602, Mr. M. Frankenburg, £500, Merz and McLellan, £500, Sir George Sutton, £500, Sir Hugo Hirst, £500, Mr. J. A. Crabtree, £500, Sir Tom Callender, £500, Sir Harry Renwick, £250, Electrical Contractors' Association, £200, Electric Lamp Manufacturers' Association, £105, Whitehall Securities, £100, Mr. H. Alabaster, £100, Mullard Wireless Service Co., Ltd., £100, Holophane, Ltd., £100, Mr. W. R. Rawlings, £75, Mr. R. S. Whipple, £50.

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New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

Improved Insulated Lampholders.

We have received from Messrs. J. H. TUCKER & Co., LTD., Kings Road, Tyseley, Birmingham, a sample of their "Telacite" insulated lampholders. One of the chief drawbacks of the bakelite lampholder, it is claimed, is that unless care is exercised in putting the lamp into the socket, it is an easy matter to break the liner, owing to the brittleness of the material. This is entirely obviated in the "Tucker" lampholder by a metal insert, completely enshrouded by the moulding material, thus rendering the liner as strong mechanically as any other part of the lampholder. Another point worthy

Fig. 1.—A "Telacite" H.O. Lampholder.

of mention is that the "Tucker" lampholders will accommodate the standard 1¼-in. hole shade, while a further feature is that the switchless holders are fitted with a special one-piece solid plunger as in the "Kwikwire" lampholder.

The cord grips are of a unique design; two self-adjusting cones in the top cap engage with the outer covering of the conductors and give an even and effective grip on any class of flexible. With heavy workshop flexible or c.t.s. cable, one cone can be omitted without in any way impairing the grip. In wiring, the cord-grip cap need not be removed; it is sufficient to slacken it back, pass the conductor through it to the wiring terminals, and then tighten up. In the skirted Home Office type, fig. 1, the necessary precaution has been taken of providing ventilation slots to disperse the heat generated by gasfilled lamps.

A Junction Box for "All-Insulated" Wiring.

For use with c.t.s. cable, so as to give an all-insulated wiring system, Messrs. SIEMENS BROTHERS & Co., LTD., Woolwich, S.E.18, have introduced a special tee or junction box, fig. 2. This is intended for surface use, and the rim which supports the base is provided with four 3-stage reductions to permit side entry for single, twin, or 3-core cables. The special advantage of this box is accessibility, due to the large central opening in the base which is supported clear of the fixing

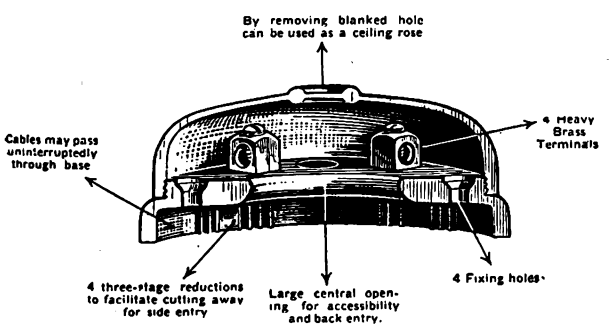

Fig. 2.—The "Siemens" Junction Box.

surface. By this arrangement cables can enter at right angles, tee, or four-way and, when required, can pass uninterruptedly through the base. By knocking out the blanked hole in the centre of the cover the box may conveniently be used as a ceiling rose. Porcelain connectors are not required, as the box is fitted with four heavy terminals.

A Remotely-operated Electric Lock.

At the recent International Exhibition of Inventions the first prize was won for an automatic electric lock, fig. 3, sent in by Messrs. E. W. PORCH and J. T. KNIGHT, of 222, Dalston Lane,

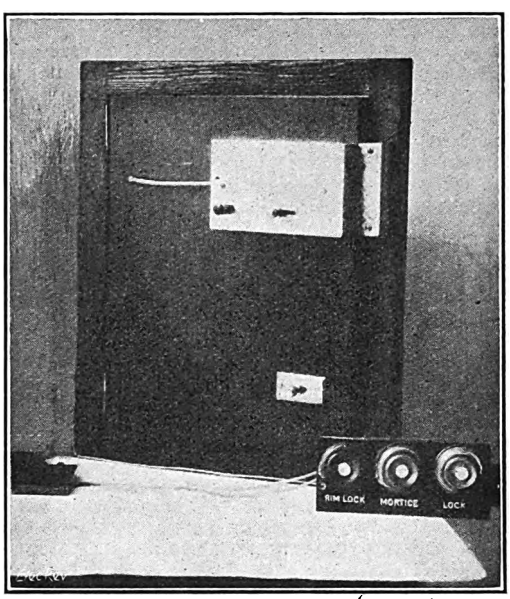

Fig. 3.—The Electric Lock as Exhibited.

E.8. It can be used on every kind of door. In the case of a bathroom a small push-button is placed just above the bath, within easy reach, and in the event of the button being pressed the door is automatically unlocked and an alarm bell is set ringing. The door can again be locked from the outside, and the bell can easily be stopped by the small knob on the lock. The lock works from a very small 2-volt dry cell. When the door is opened from a distance a small electro-magnet attracts the lever into an upright position, so allowing the spring on the bolt to force the bolt back into a retracted position; at the same time the bolt can make a contact to complete the bell circuit if necessary. When the door is opened in the usual way this contact is pushed away, so that the bolt falls back into a free aperture. By means of a slight addition the door could also be locked from a distance, a slightly larger battery being needed for this operation.

New Battery-charging Equipment.

Messrs. NEWTONS OF TAUNTON, 6, Grape Street, Shaftesbury Avenue, W.C.2, have recently placed upon the market a new

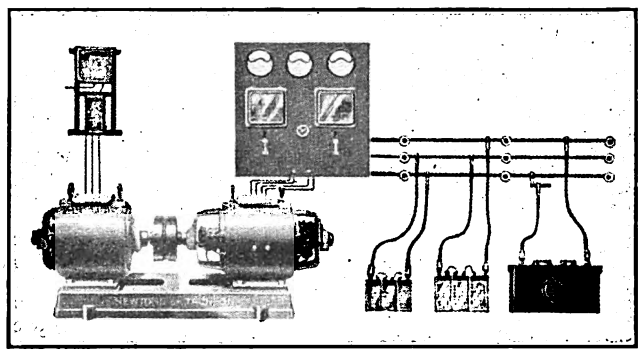

Fig. 4.—"Newton's" Constant-potential Battery Charger.

form of battery-charging equipment operating on the constant-potential system, fig. 4. This is a complete and self-contained equipment designed for charging portable accumulators of from 2 to 12 V. It is constructed for use from either d.c. or a.c. mains, and, if desired, can also be operated by belt drive from an engine or shafting. The equipment consists of an a.c. or

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d.c. motor flexibly coupled on a combined bedplate to a patent compound-wound constant-potential generator. The generator can, if necessary, be arranged to be belt-driven by an engine or shafting. Sets are supplied complete with switchboards equipped with the necessary apparatus for the adequate control and complete protection of the plant and the battery. As the constant-potential method of battery charging enables batteries to be charged in parallel, busbars are incorporated to which the batteries are connected for charging, and an ample supply of flexible leads with spring connectors is also supplied for connecting these batteries to busbars. In addition, such accessories as flexible cable, insulators, high-grade miniature busbar ammeter, and complete starting gear are also supplied. Equipments are manufactured for charging 6-volt or 12-volt battery units from two busbars, and in addition a three-busbar set is supplied enabling 6- and 12-volt battery units to be charged simultaneously. The generator for the two-busbar set is provided with one commutator, and the voltage to be connected is 8 volts for 6-volt charging, or 16 volts for 12-volt charging. In the case of a three busbar equipment the generator armature has a double winding, and two commutators are provided, each 8 volts, the arrangement being that 16 volts is given across the two outer of the three busbars, and 8 volts across either outer and neutral. The sets are manufactured in sizes from 50 A to 400 A, for dealing with any number of batteries up to 640 per week.

Electric Incubator Heaters.

In the "Curfew" electric incubator heater of ELECTRIC INCUBATOR HEATERS, Curfew Poultry Farm, Chertsey, the electric heater is in the form of a tapped element, having a minimum resistance to give the maximum heat required and a maximum resistance to give the minimum heat required. The element is divided up electrically and tappings from it are taken to the studs of a control switch. A contact is arranged under the capsule rod of the incubator, this being connected across the two arms of the selecting switch. By this means, as the contact is operated one or the other of the two selected currents is always passing through the heating element, thus producing a very steady and constant heat. The current operated by the contact is very small, being only the difference between the two selected resistances, and as this is broken at practically no voltage, the circuit not being broken, there is no spark or arc on the contact. The current carried by the contact is arranged to be enough for the normal temperature changes of the incubator room. Another point is that the contact carries only a small amount of current, which controls a few degrees of heat each side of the heat required, so that should the capsule or contact get out of order or want adjusting, the incubator would be only a few degrees high or low, not enough to do harm. To vary the heat generated by the electric heater for the different seasons of the year, all

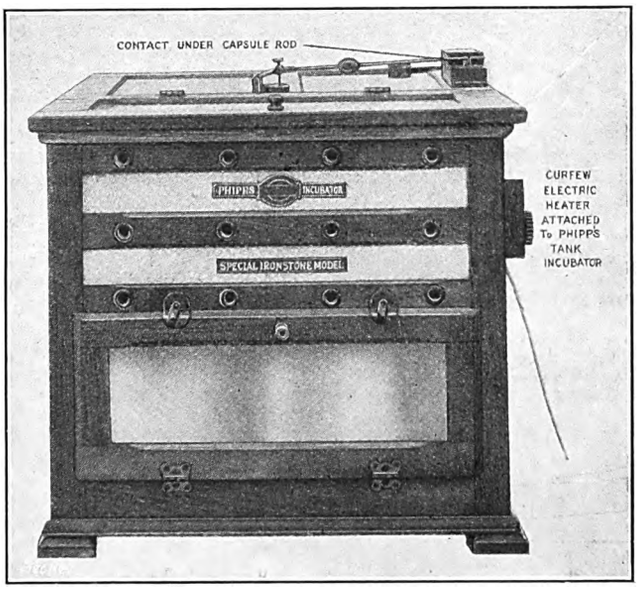

Fig. 5.—"Curfew" Electric Heater fitted to Tank Incubator.

one has to do is to turn the knob of the control switch. When the control switch is moved one stop, it does not take the contact control completely out of the range it was previously operating between, but only half way. The electric heaters are made for all types, sizes, and makes of incubators; fig. 5 shows the electric heater fixed to a tank incubator.

"Sadia" Switches.

Among the many products of SADIA, LTD., 22, Newman Street, Oxford Street, W.C., automatic time and cut-out switches form an important section. These include many interesting features. The apparatus consists of a precision clockwork movement with lever escapement and temperature compensation, fitted in the interior of an insulating dial ring and a transversely mounted drum switch, having inside the driving motor for the switch roller and for the automatic winding-up of the clock. Round the dial, which is divided in 24 hours, are mounted four movable contact rings. The hand of the clock carries a spring brush, first on one and then on the other of these rings, giving the excitation to the motor. This motor oscillates with the periodicity of the current. It has no commutator or sliding, and therefore there are no interruptions of current while working and no sparking. These oscillations are taken up by a ratchet drive, giving a rotary motion to the switch drum once the clock has been fully wound up. The clock has a reserve power of three full days. As the clock is always kept fully wound up, the pressure on the escapement is always even, resulting in perfect time-keeping. When an astronomical dial is fitted the switching on and off operations follow the curve of the sun throughout the year. The construction of the company's temperature switches is similar, except that a thermo-regulator is employed, providing an additional control. Fig. 6 shows the Z.S. type of time and cut-out switch.

New Switch-Fuses.

A recent introduction of the REVO ELECTRIC CO., LTD., Britannia Works, Tividale, Tipton, is a 15-A, double-pole switch-fuse, fig. 7, suitable for 250 volts. It has a positive action, and the switch movement is well designed to give a quick

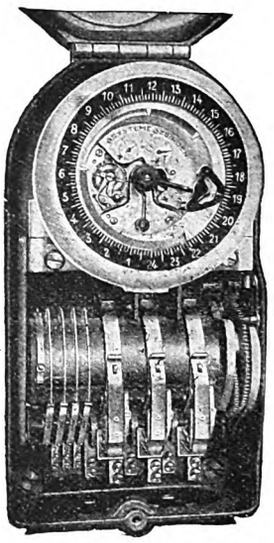

Fig. 6.—The "Sadia" Z.S.-type Switch.

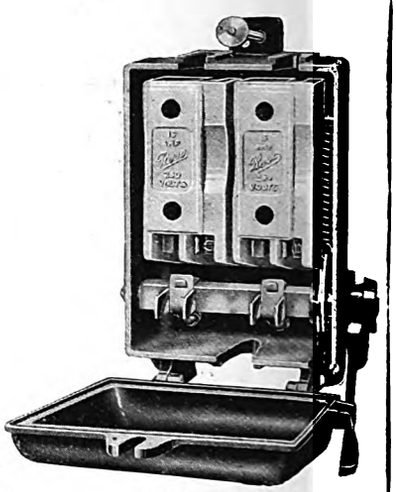

Fig. 7.—The S.6052 "Revo" Switch-Fuse.

make and break. Contacts of ample capacity are used, and these are shrouded in porcelain blocks, so as to ensure that arcing will not take place. The fuses are of the standard "Revo" quality which stood a dead-short test of 8,000 amperes, without damage to china, contacts, or case in a N.P.L. test. A new feature in the clean grey iron case is that slots have been provided at the top and bottom for cable connections, so that bushes are entirely eliminated. This robust switch should prove eminently suitable for small power and lighting installations, as it will stand, it is claimed, overloads for many hours, without overheating. Another new "Revo" model is the "Splitter" switch-fuse, which has been introduced to meet the requirements of those wishing to use a switch-fuse and two-way double-pole board complete in one iron case.

A New Cell Filler.

The CHLORIDE ELECTRICAL STORAGE CO., LTD., Clifton Junction, Manchester, has recently placed upon the market a handy cell filler which it has designed to reduce to a minimum the time and trouble taken in "topping up" cells of its "Exide-Ironclad" and "Exide" batteries with distilled water. This cell filler is particularly useful for situations in which the cells are rather inaccessible, since it enables the battery attendant to fill to the correct level, even when this cannot be watched, through the vent plug hole. When the liquid reaches the correct level a small lamp is automatically illuminated, and the operator then releases a pinch valve, thereby shutting off the further flow of water. By topping up the cells to the correct height, and no more, the density of the electrolyte is maintained at a regular value far more easily than is possible by the old uncertain method of filling up by a jug or syringe. All the cells in a battery can be topped up in this manner very rapidly, accurately, and without spilling water.

A Motor-car Battery Charger.

The RUNBAKEN MAGNETO CO., Tipping Street, Ardwick, Manchester, has recently introduced a motor-car battery charger for operation from a.c. mains. It can be used on either 6- or 12-V systems, and it is unnecessary to disconnect the battery whilst the charger is in operation. The apparatus employs an "Elkron Igranic" rectifying unit, and has an output of 3 A.

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Radio Communication.

A general outline of some of the progress made in radio-telegraphy and radio-telephony during the past two years.

By Capt. C. E. KENNEDY-PURVIS, R.N., M.I.E.E.

(*Extracts from chairman's address to the* WIRELESS SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

AN outstanding event was the fusion of wireless and cable telegraphy interests, which is all to the good. Wireless and cable services are complementary to one another for long-distance point-to-point communication. It would have been little short of a disaster for the cable services to have been pushed under. We are in an age of acute competition in communication, and every possible line must pull its pound. Cables have a distinct rôle to play, and after their long period of monopoly are being forced by stress of circumstances to push on with development and improve their technique. There is a mass of traffic to be picked up if rates are made sufficiently low, and it is up to the technical staffs, both cable and wireless, so to improve working and speed of traffic that rates can be cut and yet pay.

While the use of short waves for long-distance traffic is advancing by leaps and bounds, I venture to put in a plea that long-wave working should not be entirely abandoned. Congestion in the ether seems likely to be permanent and will probably always be ahead of technique. As additional lines are started up they will overlap such improvement as may be effected from time to time. It will be foolish to desert the development of the lower frequencies without exploiting them also to the uttermost. In time of war, even if we are neutral, short-wave working may become exceedingly difficult; a nation at war will not care much for conventions, and those countries which have kept long-wave services and their cables will have an advantage.

Radio-telephony is now a sound commercial proposition. Experiments in multiplex transmission, whereby one carrier is made to do the duty of one or more channels of telegraphy as well as telephony, show signs of promise, but it is a question whether the wave band occupied by such methods at present is not considerably wider than the sum of the wave bands which would be used by an equal number of separate stations. One important point which will require settlement soon is the encroachment of long-wave broadcasting on to the wave band allocated for air use.

Theoretical Advances.

A very considerable addition has been made to our knowledge of the theory of the propagation of waves, notably by the research work carried out in England under the auspices of the Radio Research Board and by the Marconi Company's research staff. The earlier theories of Eccles and Larmor regarding the mechanism of wave propagation have been largely confirmed by the experimental work of Appleton, Eckersley, and Hollingsworth.

Echo Effects.

Our knowledge of the echo effects produced at a receiving station on the shorter waves (which may give rise to the mutilation of signals) has been increased, and records have been taken with the cathode-ray oscillograph showing the arrival of waves which have travelled several times around the earth's perimeter. A very interesting prenomenon is the arrival of echoes after a very long interval of time (intervals of 15 sec. have been observed by Continental research workers). Whilst some workers are of the opinion that they are due to special conditions in the Heaviside layer, enabling the waves to pass many times around the earth, there is no adequate explanation at present of how the great attenuation one would expect in such cases is overcome. An alternative explanation is that such waves penetrate the earth's atmosphere and are reflected back by swarms, or bands, of electrons in space; this view has been put forward by C. Stormer. The echo phenomenon observed in short-wave reception has led to the development of directive aerial systems which tend to reduce the mutilation which the echoes otherwise cause.

Short-wave Development.

Short-wave development has been very rapid, mainly by the use of the higher-frequency regions for long-distance communication during the daylight hours. In general, the results obtainable at frequencies of from 21,000 to 30,000 kc/s are subject to very heavy fading; good communication has occasionally been established between Horsea and Hong Kong at a frequency of 25,000 kc/s, but in the case of frequencies greater than 30,000 kc/s there is no experimental evidence that they have long ranges over sea. The band between 15,000 and 21,000 kc/s has enabled communication to be obtained at long ranges over a very large proportion of the twenty-four hours by the judicious change of frequencies at various times of the year.

The success obtained with this frequency band is due not only to improvements in transmitting circuits and valves, but also in considerable measure to special forms of directive aerial systems. Apart from the Franklin vertical arrays as used at the beam stations, the most generally used types are perhaps multiple arrays of horizontal or vertical dipoles, but some interesting systems have also been developed in France by Mesny and Chiveir in which the array comprises wires arranged to form either a double zigzag or a Grecian key curtain, and for long-range working multiple arrays erected on masts of a height of less than 150 ft. have given satisfactory results. Commercially, the type of aerial array for a given service seems to be a problem of balancing power input and its cost against the cost of masts.

The Marconi Company developed its beam system for this frequency band; a service with South America is maintained by Germany at 16,500 and 11,500 kc/s; the Dutch Government has developed a considerable service between Holland and Java with frequencies of the order of 18,000 kc/s for day work and 10,000 kc/s for night working, variations being made from time to time as necessitated by seasonal changes. During the European summer period, particularly about June, practically continuous communication is maintained throughout the twenty-four hours of the day, but in winter higher-frequency communication is limited to some four hours of the day, though the lower-frequency period can be carried on for approximately 12 hours.

The British Admiralty has for some years been working a service to the east (Hong Kong and Singapore) at 8,570 kc/s, which has now been supplemented by a day-wave service at about 18,000 kc/s, and during June of this year a 24-hour service was maintained with Singapore at the latter frequency; during the winter months, however, the possible service is much reduced, but can be augmented by the use of frequencies of the order of 13,000 kc/s. The British Post Office uses 19,000 kc/s for trans-Atlantic telephony as an alternative to long-wave transmission; the B.B.C. broadcasts at 12,500 kc/s from Chelmsford (5 SW) and in Holland a short-wave transmitter near Hilversum broadcasts direct to the Dutch East Indies on the daylight wave band.

As regards British naval services, practically all H.M. ships have been adapted for short-wave working. Satisfactory results have been invariably obtained from the lower frequencies usually employed for the night services, but it is not so easy to do so during daylight. Although the use of short waves for mobile ship services is proving of great value, there is a certain limitation to their use due chiefly to the zone wherein either (*i*) interference is experienced between surface and indirect radiation from the transmitter, or (*ii*) there is a definite gap between these components of the transmission. The skip zone has been observed at sea on all frequencies above 6,000 kc/s at varying distances lessthan 1,000 miles. The band between 6,000 and 4,000 kc/s is very much better in this respect, but it cannot be said that short waves will meet the requirement of a continuous service for ranges up to 1,000 miles at sea to the same degree of reliability as long waves.

Apparatus Development.

As regards the energisation of valve anodes, high-voltage d.c. generators are used at the Rugby and some of the British Broadcasting Corporation's stations with satisfactory results. The alternative of single or multi-phase rectifiers is, however, in more general use for medium-power transmitters and especially is the use of double 3-phase rectification in favour. It has been claimed that the rectifier system gives greater security and reduces the tendency of valves to flash-over, but figures have been published to show that considerable economy results from the use of high-voltage d.c. machines for fixed station transmitters.

For the high-power medium- and long-wave transmitters the metal-glass valve with suitable cooling agents (distilled water or oil), has become well established; the silica radiation valve is also a very economical means of generating oscillatory power up to 20 kW, especially where space is limited. Con-

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siderable experimental tests on metal-glass valves of increased anode rating have been carried out by the Post Office at Rugby, but the development of high-power standardised valve units capable of being used in parallel is proceeding more slowly than at one time appeared probable.

The inherent capacity of valves imposes a limit to the permissible inductance, and it is extremely difficult to design stabilised transmitters for very high frequencies. There is increased danger of puncturing the glass envelope, and it is usually guarded against by fitting an annular ring as an internal guard to screen the seal joint of the metal to the glass envelope. In Admiralty service very considerable success has attended the use of water-cooled silica valves, and two of them in regular operation are handling from 20 to 30 kW for services to the Far East at frequencies of the order of 18,000 kc/s. The ability of the silica envelope to withstand very high voltages at frequencies as high as 30,000 kc/s without danger of puncture renders it peculiarly suitable for the generation of oscillatory power at the higher frequencies.

The tuning-fork method of frequency control, which has been in use for some considerable time at the Rugby station and at various stations of the British Broadcasting Corporation, has proved to be an excellent system of high constancy; but the very large number of stages that would be required for controlling the short-wave band of frequencies is naturally a disadvantage, and for this reason short-wave transmitters are controlled either by master circuits, as used at the beam stations, or by quartz crystals. The latter usually have a fundamental frequency of the order of 2,500 to 3,000 kc/s, and stabilised transmitters taking h.p. inputs at their final stage of 30 to 50 kW are in operation using frequencies up to the sixth harmonic of the quartz crystal.

Quartz may perhaps not give such high constancy as a tuning fork; it does, however, operate exceedingly satisfactorily when the amplifying circuits are properly tuned and neutrodyned and is capable of giving a c.w. note of excellent quality, even in the case of relatively poor regulation of the anode and filament power supplies to the transmitter, or when a.c. supplies are used for the filaments. There is usually a change of frequency with temperature of the order of 30 parts in a million per 1 deg. C., and for this reason thermostatic controls are used, but it has been claimed by certain experimentalists that careful selection of the quartz cuts may reduce the variation to the order of two parts in a million.

There has been very marked advance in the design of broadcast receivers and their components. The large amplification factor of screen-grid valves and the large mutual conductive of the pentodes have made it possible to build relatively cheap three-valve sets having a performance at least equal to that of the more ordinary types employing four 3-electrode valves; they gain in case of handling, but need careful construction and screening in order to function properly. Valves with amplification factors of over a thousand are now available and, at the same time, they have a relatively small anode-grid capacity, compared with that of the 3-electrode valve. Despite the introduction of the many new and improved valves it is, however, fair to say that for frequencies above, say, 8,750 kc/s only slow progress has been made in the development of a system of genuine high-frequency amplification. For those higher frequencies the most successful methods of reception are still by (*i*) detector valve with reaction, followed by note magnification (the quenched type of receiver may be regarded as a modification of an oscillating detector), and (*ii*) superheterodyne.

For work in the navy both these methods have obvious disadvantages, since in their simplest forms they involve oscillations in the aerial with consequent interference between ships in close order receiving the same signal. The use of detector valves in push-pull and special methods of feeding-in the heterodyne do much to reduce the difficulty in the case of the super-heterodyne type of receiver. In the case of a detector valve with reaction, however, removing the reaction from the aerial tends to reduce the efficiency of the receiver to a very great extent. It is in this connection that modern screen-grid valves have proved of great value, for it is possible by the use of one of them in front of the detector to make up to a great extent for the loss involved in removing the oscillating circuit from the aerial. This make-up can hardly, however, be regarded as true high-frequency amplification, since what amplification is obtained depends almost entirely on the fact that the anode circuit of the screen-grid valve is oscillatory, and the addition of further stages between the valve and the aerial in which reaction is not applied may even result in a loss of signal strength.

The Merchant Marine.

The Washington Convention of 1927 has had the effect of forcing the gradual elimination of spark sets from ships. No new spark set may be installed of over 300 watts after January, 1930, and all existing spark sets must be reduced to 300 watts by 1940. Large ships now usually carry a set of about 2 kW for c.w. operation over a wave range of 1,000 to 2,650 metres and i.c.w. over a range of from 600 to 800 metres. Smaller ships are now being fitted with 600-metre ½-kW i.c.w. sets. Short-wave sets are growing in popularity and a daylight wave of about 26 metres and a night wave of 36 are commonly used. Direction-finding apparatus has been further developed chiefly by way of reducing the space required for aerials and increasing the wave range. The number of ships so fitted has very greatly increased.

Congestion Limitation.

The very large development of services on all bands of frequencies indicates how the overlapping of services is tending to increase resulting interference. The subject received a good deal of attention at the meeting of the International Radio Technical Committee at The Hague during September last, a few of the agreed items being the following:—It was recommended that the power of the transmitter should mean the power in the aerial itself; methods of its measurement were included. The definitions of waves, which are quite arbitrary, were fixed at:—Long waves=below 100 kc/s; above 3,000 metres. Medium waves=1,500 to 100 kc/s; 200—3,000 metres. Intermediate waves=6,000 to 1,500 kc/s; 50—200 metres. Short waves=30,000 to 6,000 kc/s; 10—50 metres. Very short waves=above 30,000 kc/s; below 10 metres.

It was decided that no absolute international standard of frequency is practicable at present; each nation was left to establish its own standard and to arrange for comparisons with other countries. The recommended tolerance for the various orders of wave bands used by different types of station was defined as the maximum admissible departure from the nominal frequency notified to Berne (no account being taken of the modulation) and agreed to at present as follows: for short waves of from 6,000 to 23,000 kc/s (*a*) fixed stations 0.05 per cent., (*b*) land stations 0.1 per cent., (*c*) mobile stations 10 kc/s, (*d*) fixed and land stations, of 250 or less watts output, 10 kc/s. The tolerances for the future, so soon as technique allows, are to be, respectively, (*a*) 0.01 per cent., (*b*) 0.02 per cent., (*c*) and (*d*) 5 kc/s, which apply only to fixed and land stations whose waves are actually notified. In the case of mobile stations the right to use any wave of the bands applicable was agreed to.

It was agreed that each nation should establish a national laboratory with a national frequency standard, each country to monitor the frequencies of its own stations. In this country the N.P.L. standard will be regarded as the normal one and the Post Office will do the necessary monitoring.

A channelling scheme was not agreed to, but the Committee recommended that, in the reserved fixed service bands below 50 metres, frequencies allotted in kilocycles should be divisible by 5; it was agreed that a separation of 5 kilocycles is not always sufficient at present, but that in practice a separation of 0.1 per cent. is practicable. Final recommendations included:—(*a*) Waves between 50 and 13 metres should be reserved for long distances, but may be used for moderate distances from two hours after sunrise until two hours before sunset. (*b*) Waves between 50 and 85 metres should be reserved for moderate distances. (*c*) Waves between 85 and 200 metres should be used for the shorter distances.

These recommendations refer to point to point working only and are only put forward as a general principle. It was also recommended that the power of European broadcasting stations using waves between 200 and 545 metres be limited to 100 kilowatts, Russia being except at her own request. The articles of the Washington Convention which forbid any increase of power of long-wave (above 1,000 metres) broadcasting stations, if such increase would cause interference with existing services (air), were reiterated.

Battersea Power Station.

The Elimination of Sulphur from Flue Gases.

THE White Paper issued by the Ministry of Transport, entitled the "Treatment of Sulphur Fumes in connection with the working of the proposed Electric Power Station of the London Power Company at Battersea" (Cmd. 3,442, H.M. Stationery Office, price 6d.), of which preliminary notice was given in these columns last week, contains two interim reports. The first is by Messrs. E. Ardern and R. V. Wheeler, advisers to the company, and is based upon experiments conducted by Mr. G. W. Hewson, chief chemist of the company, at the Grove Road power station.

It appears that when the Battersea power station is in commission the three boilers will yield a maximum of about 510,000 cu. ft. of flue gases per minute, containing 10 per cent. of carbon dioxide.

It is assumed that the flue gases from a coal containing 1.5 per cent. of sulphur will contain about 0.03 per cent. SO_2 and 0.05 per cent. SO_3 by volume.

Small scale experiments at the St. Pancras power station gave an indication of the character of the problem as one of "gas-scrubbing," the main practical consideration being whether the chimneys (and perhaps the flues) of the proposed plant will provide sufficient scrubber capacity.

Two facts are evident, having regard to the obvious desirability of reducing to a minimum the amount of water to be used:—(1) the time of contact between the flue gases and the water is all-important, and requires to be determined experimentally; and (2) the proportions of SO_2 and SO_3 in the flues gases require to be accurately known, for SO_3 can be more easily removed than SO_2. It is conceivable that,

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either by treatment of the coal on the grate or by treatment of the gases in the flues, the formation of SO_3 can be encouraged.

Experiments on a reasonable working scale were put in hand at the Grove Road power station. The plant consisted essentially of a cylindrical absorption tower, 27 ft. high and 40 in. in diameter, with attachments for the delivery of the gases and water in contra-flow.

Two classes of coal, "Northumberland rough smalls" and "Scotch washed peas," were used. The former was of high (3.64 to 3.90 per cent.) and the latter of low (0.99 to 1.23 per cent.) sulphur content.

Tests with Cold Water.—The water entered the scrubber at 66° F. and left at 85° F. (average temperatures).

From the experiments it has been concluded that, when the time of contact of the flue gases with the wash-water is over 12 secs., there is complete removal of the sulphur gases, even when their original concentration is high, if sufficient water is used. As the velocity of the flue gases increases, the efficiency of removal of the sulphur gases decreases, but it is still high (90 per cent.) with times of contact as short as 7 seconds.

Tests with Hot Water.—The temperature of the gases leaving the scrubber must not be too low, lest there should be objectionable condensation of moisture, and downward flow when they met the air. Any downward flow might be avoided by delivering hot air near the top of the chimney stack to mingle with the flue gases after they were washed. The use of hot water might be equally effective.

The temperature of the water used averaged about 145° F. The temperature of the gases entering the tower averaged about 190° F. and their temperature on leaving was about 140° F.

The use of an excess of water (quantities up to 65 tons per ton of coal burnt were tried) was not advantageous, whilst a series of tests when low-sulphur coal was being burnt showed that as little as 6 tons of water per ton of coal burnt could effect a 90 per cent. removal of the sulphur gases (gas velocity 3.2 ft. per sec.).

A striking feature of the tests with hot water was the absence of any smell of SO_2 in the wash-water and of sulphites and thiosulphates. When using cold water this smell was always noticeable, and analysis showed the wash-water to contain sulphites.

Thus, by the use of hot water, the desired transformation of the SO_2 of the flue gases into SO_3 has been effected. The manner in which the transformation from SO_2 to SO_3 is effected, whether by the catalytic action of dust in the flue-gases or by the formation of ozone or hydrogen peroxide during the evaporation of the hot water, is still the subject of experiment.

The scheme for the treatment of the gases at the Battersea power station more than fulfils the requirements indicated by the Grove Road experiments, and allows for additional treatment, a final washing with a slightly alkaline solution. To guard against the emission from the chimney stacks of gases saturated with water-vapour, arrangements are to be provided for delivering hot and dry air to the stacks, either just above the "eliminator plates" (which will trap entrained moisture) or at any point higher up the stacks.

The neutralisation of the wash-water will be effected by mingling it with the "condenser" water, the volume of which will be about 40 times that of the wash-water.

An analysis of the mixture made at Grove Road gave the following figures in parts per 100,000:—Alkalinity (as $CaCO_3$), 15.30; sulphate (as SO_3), 3.70; total sulphur (as SO_2), 3.77.

The only alteration in the character of the river water would be a slight diminution of the carbonate content and a corresponding increase of the amount of sulphate present.

The Government committee agrees that the possibility of eliminating nearly the whole of the sulphur gas present has been proved. It considers, however, that a more definite explanation of the mechanism of the oxidation of sulphurous to sulphuric acid should be forthcoming before it can report on the practicability of the process. The committee adds that the alkalinity of the Thames near Battersea is about 20 parts per 100,000, and that 500 tons would have twice as much alkalinity as would be necessary to neutralise the sulphur acids from one ton of coal containing 1.5 per cent. of total sulphur, even assuming no sulphur to remain in the clinker. Thus, no acid effluent could pass into the river, and the possibility of calcium sulphite remaining in solution to deplete further the oxygen in the river could be overcome by changing it to calcium sulphate before the discharge of the effluent.

Modern Steam Generators.

High Efficiencies obtained at Power Stations of Simple Design.

IN his address to the London Local Technical Group of the Electrical Power Engineers' Association recently, Mr. Percy E. Rycroft, M.B.E., M.I.E.E., enumerated the fundamental essentials of a steam-raising plant as: reliability; the absorption of the maximum number of heat units liberated by the furnace, not only at its normal evaporative rating, but also at intermediate loads and overloads (without sacrificing this quality in favour of "flexibility," *i.e.*, a rapid response to slight damper adjustment); the minimum amount of adjustment during operation; and accessibility of the centres of adjustment. It was next necessary to meet the demands of the turbine builders for higher steam pressures and temperatures, and also to keep pace with the rise in the size of turbo-generator units.

From the Commissioners' latest returns—for the year ended March 31st, 1929—he tabulated the first hundred in descending order of efficiency. On the same table he added the type of steam generators installed and the system of firing adopted in each case, together with the annual load factor and the yearly output in units. The higher steam pressures were also noted where such were employed.

Broadly, the higher pressures were all located near the top, and, but for the fact that Padiham—the leading station—operated at only 250 lb. per sq. in., there would appear to be considerable evidence that the higher pressure plants had the advantage.

Large output and high load factor did not of themselves ensure good results. Beyond 20,000 lb. per hour, if it were assumed that the plant were properly worked, little or no difference in efficiency could be credited or debited to the size of unit.

The table showed a decided weight of evidence in favour of the sectional or header type of water tube boiler with horizontal tubes. Ferrybridge, as a newcomer with vertical heat tube boilers, was a notable exception to this rule, but had the advantage of a load factor of over 50 per cent., as against the 42, 44, and 46 per cent. of the first three stations on the list.

The predominance of the travelling or chain grate type of stoker was overwhelming. There was no station in the list completely equipped with pulverised fuel firing except Brimsdown B, which had not a full year's working to its credit; of the partially equipped stations, Barking and Lister Drive No. 3 made the best showing, but there was nothing to indicate the relative proportions of load borne by the pulverised fuel sections in either case. It could safely be said that so far no station had been carried into the front rank of efficiency by this method of firing.

The outstanding fact was that to all intents and purposes the main design and layout of the Padiham was identical with good practice of 20 years ago. Simple land type sectional header boilers with horizontal tubes and longitudinal drums, cast-iron vertical tube economisers set at the rear of the boilers, integral superheaters raising the final temperature of the steam to only 620 deg. F., a boiler working pressure of 250 lb. per sq. in., and a rated evaporation of 35,000 lb. of water per hour, giving the very modest rating of well under 4 lb. of water per sq. ft. of heating surface. The units were set in brickwork, and fired by means of mechanical chain grate stokers, operated for the most part under natural chimney draught conditions, with only 0.4 in. draught at the boiler dampers, and equipped with induced draught fans for emergency use only. The result for two years in succession had been an overall thermal efficiency of over 21 per cent.

The Barton boiler-house—which came second in the table—afforded a striking contrast to the simplicity of Padiham. In the nine original units two sets of horizontal tube sections were placed back to back, and connected into a common steam drum, the furnaces being also double, and fired at both ends. In later units this arrangement had been discontinued in favour of the standard single-ended type. Each complete unit was designed for an evaporation of from 100,000 to 120,000 lb. of water per hour. Steel tube economisers were superposed above the boilers, and tubular air preheaters were further superposed above the economisers. The complete plant was constructed for a working pressure of 375 lb. per sq. in., and the furnaces were equipped with chain grate stokers operating either with mechanical induced draught only or with combined forced and induced draught. The overall efficiency obtained by this plant over a considerable number of years were consistently good, and in 1929 was 21.31 per cent. The two essential differences between this plant and Padiham

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were that at Barton air preheaters were installed, and forced draught utilised.

The third example of high efficiency plant was that at North Tees. This operated at the highest steam pressure so far employed by any British power station, *i.e.*, 475 lb. per sq. in., and had no economisers, relying entirely on air preheaters for recovering the heat units which passed the boiler. It was the first station to employ steam reheating between the turbine stages by returning the partially expanded steam to the boiler unit. The overall efficiency obtained in 1929 was 21.19 per cent.

The last of the high efficiency plant mentioned was Ferrybridge, the keynote of which installation, as in the case of Padiham, was simplicity. The boilers were of the vertical tri-drum type, with bent tubes, and each unit was complete with integral steel tube economisers placed immediately at the rear of the boiler. The working pressure was 300 lb. per sq. in., and the normal evaporation for each unit was 75,000 lb. of water per hour. Ferrybridge had a single-floor boiler house, with chimneys erected from the ground level, and no air preheaters. The furnaces were equipped with chain-grate stokers arranged to operate either with induced or with induced and forced draught.

Among the modern steam generating plant of to-day, the most efficient was at the same time the simplest in design, and the one which had departed least from well-established practice.

The outstanding feature of these new stations was the practically universal adoption of water-cooled furnace walls. This was one of the definite results of higher furnace temperatures due to more perfect combustion. A judicious blending of both metal and refractory surfaces was called for in order to obtain the best results, and the remarkable life which had already been attained by furnaces thus equipped rapidly covered the additional cost. Almost equally indisputable was the necessity for fitting all modern steam plant with simple equipment for the systematic removal of soot and fine ash from the heating surfaces. Apparatus was available which would readily collect all but the very finest particles of grit, and, by the added refinement of water sprays, the very finest could be dealt with satisfactorily. The power stations would very soon be able to recover at least 75 per cent. of all the sulphur they produced.

In this country technical opinion as to the advantages of pulverising coal for firing under steam boilers had undergone a considerable change during the last year or two. Central systems had given place to bin and feeder systems, and these in their turn had been superseded by direct firing plant. Long-flame vertical burners had been displaced by horizontal turbulent burners, and there had been many varieties of mills. While certain qualities of coal might advantageously be pulverised, it was equally certain that many of our coals could be burned at least as satisfactorily in a solid form by mechanical stokers.

A discussion followed in which Messrs. Wilson, MacGuire, Samuels, Oswald, Blenkinsop, Wallis, and Nunn took part.

Registration of Power Plant Tests.

A Plea for the Authentication of Data.

THERE can be little doubt about the importance of the subject dealt with by Mr. R. H. Parsons in his recent paper before the Institution of Mechanical Engineers, his object being to call attention to the need, which is felt by all engineers, for some official registration of authoritative tests of machinery. Such registration, it is believed, would secure to manufacturers the credit they deserve, would protect them to some extent from unfair competition, and would furnish designers and others with unimpeachable data as to what had actually been accomplished by particular machines. To carry out the work of registration it is proposed that an organisation should be set up, preferably under the auspices of the leading engineering institutions, and directed by men whose known competence and integrity would ensure general confidence in its decisions. The organisation should, in time, become self-supporting, deriving its income from fees charged for the consideration of cases submitted for registration and from the sale of its records. Such, in brief, is the scheme which Mr. Parsons examined in detail. The author has no intention, of glorifying test results in any way; if a test is regarded, as it ought to be, simply as a special performance of plant, conducted under strict rules, for the purpose of ascertaining its technical efficiency under stipulated conditions, it is not to be blamed because it cannot prove more than it purports to. Its limitations are obvious and freely admitted, yet the fact nevertheless remains that a properly authenticated test affords the only possible means of demonstrating that a machine, or plant, is capable of doing what its makers have claimed for it. They become, moreover, increasingly important as larger and larger units are considered and greater and greater sums of money are at stake. It is, therefore, as useless to belittle the value of tests as it is foolish to overrate it. The wise man does neither, his object being to ensure that the figures propounded shall be intelligibile and accurate. It is common knowledge how large a part test results play in commercial propaganda. The enthusiasm of the sales engineer is legitimate, and competitors will naturally be driven to adopt a similar procedure, for ordinary business ethics and commonsense forbid them to defend themselves by throwing doubt on the claims of a rival. Consequently they must strain every nerve to produce still better figures for their own propaganda, and so technical progress results and the standard of efficiency is raised, but there is always the danger of emulation causing promises to outrun performances. Every time a specially good test result is recorded by a firm competitors must endeavour to beat it, and the less scrupulous may yield to the temptation of claiming, without proper justification, even better figures, or at least of guaranteeing to get them. Those makers desiring to be honest and conservative in their guarantees find themselves at a disadvantage, lose orders they properly deserve, and see their prestige in design and manufacture passing to less worthy rivals. The evil could be met by insistence upon rigid tests to determine whether guarantees have been fulfilled, but who is to do the insisting? The customer can, but thorough tests are tedious and costly. What is wanted now is some means of securing general acceptance of such test figures as are worthy of belief, so that they could be reasoned from without their reliability being called into question. This, it is suggested, could be done most easily by the setting up of an official register, to the pages of which would be admitted only the records of properly authenticated tests of power-plant machinery, carried out and reported strictly in accordance with the requirements of a code.

It should be no part of the duties of the committee to express any opinion concerning a test, and especially any opinion whether guarantees have or have not been met. It would confine itself strictly to the task of registering the actual figures obtained, having first assured itself that they were reliable and conformed to the requirements of the code. It would be very useful if some impartial international committee of engineers could publish a register of properly authenticated tests carried out in all countries. The time for such co-operation has, however, not yet arrived. Let us get a register of our own first. Meanwhile the British register would, of course, be open to all foreign manufacturers who complied with British standards of testing and fulfilled the conditions imposed on their British competitors.

Legal.

Merchandise Marks Act Summons.

A SUMMONS under the Merchandise Marks Act, against Walter J. Edwards, Arthur N. Edwards, and Thomas D. Edwards, trading as Edwards Brothers, 20, Blackfriars Road, S.E.1, was heard at Tower Bridge Police Court, before Mr. Oulton on November 26th. Defendants were summoned for advertising cable for sale without indicating the country of its origin.

Mr. St. J. HUTCHINSON, representing the Cable Makers' Association, said he understood that the defendants would plead guilty. Under the Act of 1887 defendants were entitled to go for trial; the offence was actually under that Act although proceedings had been taken under the Act of 1926. Mr. A. H. OSMOND, for the defendants, asked the Court to deal with the case.

Mr. HUTCHINSON said that the Act laid down that if any person offered for sale any imported goods of any specified class or description without indicating their origin they were guilty of an offence. By an Order in Council made in 1928, insulated cable was brought under the Act and defendants should have shown in their advertisements either the place of manufacture or the word "foreign." They advertised "Grey Cable" as a cable passed by the Cable Makers' Association. This particular cable was advertised as a product of "Siemens Schuckert (Great Britain)," a German company, and people reading that description would come to the conclusion that the cable was made by an English firm. In pursuance of its objects the C.M.A. bought a length of the cable in question, which bore a ticket showing that it was manufactured by Messrs. Siemens-Schuckert, Berlin, and it also bore the mark "Made in Germany." If the cable had been purchased in smaller quantities there would have been nothing to show where it had been made.

MR. OSMOND said that his clients acted in ignorance. The goods were labelled according to the Act and also bore the words "German Manufacture." They had advertised only in trade papers.

MR. ST. JOHN HUTCHINSON said that defendants had been circulating the advertisement by post.

MR. OULTON said that the impression that the cable was of German manufacture would be removed by the words "Great Britain," which might be taken as an indication of the place of origin.

MR. OSMOND said that the words "(Great Britain)" were a part of the firm's title. It was only a distributing company.

Defendants were fined £2 each and ordered to pay £5 each as costs.

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Farnworth v. Manchester Corporation.

JUDGMENT was delivered in the House of Lords on November 28th, by Lords Dunedin, Sumner and Blanesburgh, in the appeal of the Corporation of Manchester brought against the judgment of a majority in the Court of Appeal given in favour of Mr. Arthur Farnworth, a Barton-upon-Irwell farmer, who brought an action to recover damages for injury arising from vapours from the chimneys of the Corporation's Barton power station, and asking for an injunction restraining a continuation of the nuisance. Judgment was reserved on July 16th. A unanimous result was arrived at, though their Lordships came to the same conclusion by different means.

Lord DUNEDIN pointed out that the case had given rise to much difference of judicial opinion, and that its decision was not only of great moment to both the parties concerned, but its aspects brought up a question of the widest public importance, and it would be well indeed if it could be brought home, not merely to those interested in the development of the law, but to those who in the future were in the posittion which enabled them to settle and control the position of great electrical stations.

Their LORDSHIPS arrived at the conclusion that the appeal should be dismissed with certain modifications, and declared that the damages to be recoverable against the defendants should be such as had been sustained by the plaintiff up to the date when the injunction by the order awarded should have ceased to be suspended, or should have been dissolved, whichever event should first happen. That immediately after the injunction there should be inserted in the Order the following clause:—"With liberty reserved to the defendants to apply to a judge of the King's Bench Division to dissolve the said injunction (*a*) on their establishing, if it be not admitted by the plaintiff, that they have exhausted all reasonable modes of preventing mischief to the plaintiff; and (*b*) on their submitting in the future conduct of their power station to adopt and use the most effective of these modes until they have replaced them by other reasonable, but more effective, modes of prevention which may thereafter be discovered, and which will hereafter be adopted and used." That the first suspension of the injunction should continue for one year from the date of the Order of this House in lieu of one year from the date of the Order of the Court of Appeal.

Lord DUNEDIN moved that, with these modifications of the Order of the Court of Appeal, the appeal be dismissed with costs, and that the cause be referred to the King's Bench Division to act in accordance with their Lordships' declaration, the respondent to have the costs of the appeal to the House. It was ordered accordingly.

Compensation Claim.

IN the Shoreditch County Court, on November 28th, before Judge Cluer, there was an application under the Workmen's Compensation Act by Annie Catherine Clark, of 6, Kenninghall Road, E., for compensation for the death of her son, Thomas Clark, a fishmonger's assistant, who received a fatal electric shock at the premises of Mr. Alfred Cohen, of 7, Grand Parade, Green Lanes, Harringay, N. It was alleged that on July 11th he took up a white apron which had been placed on a line, and in doing so came in contact with an electric wire, and he received a shock which caused instant death. He had been receiving £3 a week, and the mother now claimed £300 compensation, as she was totally dependent upon his earnings. The defence was that the accident did not arise out of, or in the course of, his employment, and that the applicant was not totally dependent upon the earnings of the deceased man. Counsel for the applicant said that in the yard at the back of the fishmonger's shop there was a fence on which were run wires which worked an apparatus and supplied electric light for the fish cleaning shed. It was a custom of the men to put their white aprons on this to dry. The deceased man was seen sweeping in the yard, and he then must have touched the apron, for a few moments afterwards he was dead. His mother had been kept by the deceased, who gave her £2 a week. Evidence was given that the tubing had deteriorated, and the resistance was faulty. The maximum voltage was 240. Judge CLUER said he was satisfied that the proper inference to draw was that the man died from an electric shock, and he awarded the mother £300 compensation and costs.

A Partnership Claim.

BEFORE Judge Chapman, at York County Court on November 26th, George Baker, of Hampden Street, York, claimed £90 4s. 7d. balance due for money lent and interest, against Sydney Allen, electrical engineer, Burlington Avenue, York.

The plaintiff's solicitor said that in 1927 his client lent £200 to his son to be invested in an electrical business. The son put the £200 into a business with the defendant with a view to a partnership. Allen brought no money into the business, but he had some contracts. An agreement was drawn up providing that Ronald Baker should take 75 per cent. of the profits and defendant 25 per cent. until such time as their capital became equal. The plaintiff in the action was later approached by Allen to secure his agreement to a proposal that Allen should take over one-half of the capital liability, £100, so that the shares would be equal.

PLAINTIFF, in the box, said the money was lent in 1927. He received a total of £40 12s. 6d. from his son in repayment, and later issued a writ securing judgment for the balance of £159 7s. 6d. Subsequent to that judgment Allen called on him and wanted to borrow a further £100. A document was drawn up, but since it was signed plaintiff had received only £14 10s. from his son and a similar amount from Allen. The amount he now claimed was in respect of the balance and interest. Plaintiff further said that he had had nothing to do with the business, and had never received any money direct from Allen.

ALLEN, in the witness box, said he did not remember signing the original partnership document.

After examination of documents the JUDGE said he was satisfied that the signature was in defendant's handwriting. He found judgment for plaintiff for the amount claimed; and he gave further judgment for Allen as against the plaintiff's son in respect of a cheque for £57, paid on the dissolution of partnership, which it was alleged had been dishonoured.

Parliamentary News.

By Our Special Parliamentary Reporter.

The Grampian Hydro-Electric Bill.

Owing to the illness of Lord Clanwilliam, the Chairman of the House of Lords Committee, which is considering this Bill, proceedings upon it were recently suspended.

Consideration of the Bill was proceeded with last week, the Marquis of Bath presiding.

Mr. IAN MACPHERSON, M.P., gave evidence in support of the measure, and said that resolutions in favour of it had been passed by a number of neighbouring local authorities. He thought that once a cheap supply of electricity was available in the district, factories and works would be established there. Mr. H. RICHARDSON (formerly Dundee city electrical engineer) also gave evidence, of a technical character, in favour of the scheme.

Wireless Telegraphy and Broadcasting.

On November 26th, on the Committee stage of the Expiring Laws Continuance Bill (which continues, for another year, certain Acts which would otherwise expire), Capt. BOURNE moved to omit from the scope of the Bill the Wireless Telegraphy Act, 1904. He said that at the time the Act was passed no one dreamt that we should get such an elaborate system of broadcasting as we had to-day, that the entire authority should be the Postmaster-General as the licensing authority for all, and that he should actually depend on an Act of Parliament for an entirely different purpose. It was time that the Act dealing with wireless was brought up to date.

Mr. LEES-SMITH, the Postmaster-General, said that the 1904 Act had given the holder of his office an elastic authority by which he had been able to act quite effectively and fairly as "the policeman of the ether." It would be impossible to pass an amending Act this year. Also, it would be better to wait a little longer in view of the fact that there was to be an international wireless telegraphic conference in Madrid in two or three years, and that that conference was likely to adopt certain conventions which would need legislation in the Parliaments of the ratifying States, so that it might very well be that the Government would have to bring in a Bill on this subject in two or three years' time.

Viscount WOLMER then put a number of questions regarding broadcasting, the number of wireless licences now in existence, and the new station at Brookman's Park. He also asked for information as to the trans-Atlantic telephone service. He next referred to the Act, passed by the last Government, leasing the beam wireless services to the Imperial Communications Company. He asked if those services had actually been transferred to that company, and if any practical difficulty had been found in the working between the Post Office and the Company. Finally, he asked the Postmaster-General to tell the House something about the great disturbance which took place in the Atlantic recently. That earthquake, which put something like eleven cables out of action, proved what an excellent future the beam service had if it were fully developed. Had it not been for that service, the whole of the communications between this country and America, and, indeed, to all the countries from which telegrams were carried on from America, including Australia, would have been hopelessly congested for many weeks.

After further debate, Mr. LEES-SMITH said he did not intend to make any alterations in the system under which broadcasting licences were issued. The total number of such licences now amounted to 2,869,000; the number would soon reach 3,000,000, at which stage the Treasury took a larger proportion of the licence fees. With regard to the Brookman's Park experiment, the station there was working on a single wave, and the great change would come when it worked on the double wave. That stage would be initiated in a few weeks' time, but it would not be fully operated all at once. Probably it would be worked for half an hour a day, and then

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it would be increased as the public became accustomed to the new development. The substantive agreements for the transfer of the beam wireless stations were signed on the day before the General Election last May. The transfer was now complete. With regard to the recent earthquake, both the cables taken over by the Communications Company had broken down, but the messages were transferred and carried by beam wireless, with the result that the service, although interrupted and delayed, was satisfactorily carried through. As to television, the negotiations that had taken place had resulted in the Baird Television Company obtaining the right to use the B.B.C. stations for half-an-hour on five days a week out of broadcasting hours. The Fultograph experiments had now come to an end.

The amendment was rejected, and the Bill afterwards passed through Committee and was read a third time.

Overhead Telegraph Lines.

On November 26th, Mr. A. Smith asked the Postmaster-General if, before the erection of overhead telephone or telegraph lines, he would consult with the local authority of the district, as in the opinion of some authorities overhead lines created a nuisance or destroyed the amenities of the neighbourhood, and were not as suitable as underground lines.

Mr. Lees-Smith replied that, in accordance with the provisions of the Telegraph Acts, the consent of the local authority was sought before any overhead line was placed in any public road under their jurisdiction and consultation, if necessary, followed. Due regard was paid to the question of amenities in framing applications for such consents, and the lines were laid underground whenever this could be justified financially.

The Transatlantic Telephone.

On November 26th, Mr. Lees-Smith informed Mr. Day that the total number of trans-Atlantic telephone calls during the six months ended October 31st was 7,737. The service was self-supporting, so far as Great Britain was concerned.

On November 26th, Mr. Lees-Smith informed Captain Cazalet that the net growth in the number of telephones installed during the year ended September 30th last was 123,409. The net increase in the number of residence telephones during the year was 50,428. The number of residence telephones at present in service was more than double the figure of five years ago.

The Battersea Power Station.

On November 27th, Sir Kingsley Wood asked the Minister of Transport whether he was now in a position to make a further statement as to the projected Battersea power station, particularly as to the Government's intentions on the interim report of the Government's chemists in relation to experiments on the prevention of the emission of oxides of sulphur.

Mr. Morrison said that the interim report had just been published, and it was proposed to await a further report.

Electrical Development.

On November 27th, Major Nathan asked the Lord Privy Seal if he was now in a position to state whether, in connection with the Government's plans for the reduction of unemployment, he had taken, or proposed to take, any action to accelerate the carrying out of the work of the Electricity Commissioners.

Mr. Lansbury, who replied, said that the Electricity Commissioners, in a circular recently issued, had urged all electricity undertakings to accelerate their expenditure on development so as to provide increased work in the next two years. The Central Electricty Board had also been requested to continue to press on with all possible speed with its constructional work.

L.N.E.R. Electrification.

On November 27th, Major Nathan asked the Minister of Transport whether, in connection with the Government's unemployment plans, steps had been, or were being, taken leading to the construction of an electric railway from Liverpool Street, *via* Bethnal Green, to Leyton and Waltham Cross, and to Ilford and Hainault Forest.

Mr. Morrison said that no proposals had yet been submitted to the Government by the railway company concerned for the construction of such railways.

East African Plans.

On November 27th, Mr. Hannon asked the Under Secretary of State for the Colonies if he could make any statement relating to the delay in the adoption of a scheme for the supply of electrical power in the Tanganyika territory; if his department had received any report on the proposed hydro-electric station at the Pangani River Falls; and if he would take steps to accelerate the project with a view to contracts being placed in this country.

Mr. Lunn said that negotiations were in progress with regard both to the general development of electrical power in Tanganyika and to a scheme for the production of electric power from the Pangani Falls. Every endeavour had been made, and would be made, to expedite the matter.

A Welsh Scheme.

On November 27th, Mr. Haydn Jones asked the Lord Privy Seal whether his attention had been called to the delay in extending the electric line from Maentwrog to Barmouth and other towns on the Welsh coast; and whether he would include this extension as part of the Government plan for the relief of unemployment.

Mr. Lansbury, who replied, said that the Barmouth Urban District Council, by an Act passed in July of this year, obtained authority to give a supply of electricity in an area including its own district, and was under obligation to lay certain compulsory mains for the purpose of giving that supply within a period of two years. The Electricity Commissioners had been informed that the question of the construction of the electric line from Maentwrog to Barmouth was now receiving the close attention of the North Wales Power Company, which was the body charged with the duty of affording bulk supplies of electricity. The attention of all electricity supply authorities had recently been drawn to the financial assistance which was available under the Development (Loans Guarantee and Grants) Act, 1929, in respect of carrying out works in acceleration of normal development. It was doubtful, however, whether the works referred to could be regarded as accelerated expenditure.

Special Orders.

Special Orders have been approved in respect of parts of the rural districts of Escrick and Pocklington, in the East Riding, Easingwold, Flaxton, and Malton, in the North Riding, and Great Ouseburn, in the West Riding of Yorkshire, and for the amendment of the York Electric Lighting Orders, 1890 to 1914; the borough of Congleton and the urban district of Buglawton, Cheshire; part of the parish of Weston, in the rural district of Runcorn, Cheshire; parts of the rural districts of Cuckfield and Chailey, East Sussex, and for the amendment of the Haywards Heath and District Electricity Special Order, 1922; in respect of part of the rural district of Aysgarth, in the North Riding of Yorkshire; the urban district of Wimborne Minster and parts of the rural districts of Poole and Wimborne and Cranborne, Dorset; part of the rural district of Salisbury, in the county of Wilts, and part of the rural district of Fordingbridge, Southampton; the burgh of Dunoon, Argyll; parts of the rural districts of Aysgarth and Reeth, in the North Riding of Yorkshire; and the parish of Downton, in the rural district of Salisbury, Wiltshire.

The Indo-European Telegraph Co., Ltd.

In the House of Commons, on November 28th, Mr. Thurtle asked whether, in view of its interest in Imperial and International Communications, Ltd., the Government had been consulted with regard to the company's proposal to purchase the Indo-European Telegraph Co., Ltd., and, in particular, to the offer to pay a large sum of money as compensation to the Indo-European Co.'s directors.

Mr. Snowden said that the Government had not been consulted. It was merely a partner in the Communications Co., and if any representations were made they would go to the Imperial Communications Advisory Committee on which each of the partner Governments was represented.

The Co-ordination of London Transport.

In the House of Commons on Monday, Mr. H. Morrison, Minister of Transport, made a statement with regard to the Government's intentions in the matter of the co-ordination of London passenger transport undertakings. The matter is referred to in a "leaderette" in this issue.

Correspondence.

Correspondents should forward their communications as early as possible. *No letter can be published unless we have the writer's name and address in our possession.*

The All-Electric House.

In reply to Mr. F. J. Moffett, I am one of those engineers who realise that the heating of rooms and water supplies by electricity has a very considerable contra item to place against the "wastage of national fuel supply" argument. That item is the well-being, ease, and comfort of our women folk.

Personally, I have used coal, coalite, the gas fire, and gas cooker, so can claim some experience. The work required with coal or coke heating is considerable; for even the best coke-fired boiler requires cleaning periodically and ashes removing, whilst it is—whether Mr. Moffett likes the fact or not—assisting to pollute the atmosphere.

As for gas fires, well, when forced to use this type of heating, I purchased the best modern gas fire I could obtain, built it into the fireplace, and attached a 36-in. ventilator, fitted with a cowl, running up the chimney, from the top rear portion of the gas fire. The fire was very pleasant, very warm, and convenient; but—sitting near it for an hour induced sleepiness. This experience was common to the household—not only to myself. I have never yet found a room heated by gas fires in which I do not experience this unpleasant sleepy feeling; it was followed, in the case of my wife, by headache. When the opportunity came, the gas fire was converted by fitting two Belling elements. There is now no unpleasant drowsiness when sitting near the fire.

Another point must be mentioned. This last month I have changed houses. The only fire used in the old house for over

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2½ years has been the kitchen fire; finding that there was a fair stock of coal in the cellar, the front room radiator was disconnected and coal fires used again. The difference in work and coal consumption is amazing; also, it may be emphasised that the work from which the household is relieved by the radiator is dirty and unpleasant, whilst the draughts set up by the brightly burning coal fire are quite noticeable, in contrast to radiator heating, with which no ventilation trouble happens. The radiator is set with its back to the hearth, but not blocking completely the ingress to the chimney. The plea that a coal or coalite fire is so much pleasanter is sentimental nonsense. The coal fire now does not appeal to me as pleasant, but as crude, dirty, and inconvenient.

Concerning the cost, for fourteen lights, two radiators, one 6-kW cooker, two bowl fires, one electric iron, one electric kettle (three-pint size) with the front door bell and wireless thrown in, my heaviest bill was, last December to March, £6 4s. 1d., including ratable value charge, and the hire of cooker and kettle. Energy used, 2,612 at ½d. per unit.

This period included the severe weather in the early part of this year. We located two critical places in our water system, and from 11 p.m. to 7 a.m. for sixteen days kept a bowl fire under each place. We were saved the mess and inconvenience suffered by our neighbours who did not work their houses "all-electric." Another point; the 750-watt bowl fire used for the upstairs pipe was used by my wife while retiring, then taken into the bathroom and put under the critical pipe, being taken again to the bedroom shortly after 7 a.m.

Can Mr. Moffett achieve such comfort and protection as cheaply and with as little work by his method? Can he start the gas engine up whilst lying in bed? And can he feed the central heating stove by closing a switch?

Coming to the gas cooker, well, I have yet to find the gas cooker which cannot be detected before one enters the kitchen. Gas cooking is convenient, but the fumes simply cannot be controlled and coaxed away so as to be unnoticeable.

No flues have had to be blocked up to warm the radiator heated rooms; a far better and more scientific method of obtaining adequate heat for a fair-sized room is to use two bars of a 3-kW radiator situated near the hearth, and a 750-watt bowl fire between the door and the radiator. One bar and the bowl fire will suffice in all but the severe weather.

When using gas and coal we required 6 tons of coal a year at a cost of £12 to £13, even when we were very careful. The winter quarter gas bill, after discarding the gas cooker, but retaining a griller, was always over £3, including cost of mantles and cleaning of globes and fittings, but not of cleaning out the service pipe to the gas-fire occasionally. Electricity, all in, costs me about £15 per annum, and in addition £2 to £2 10s. has to be paid for coal and coalite for the kitchen fire.

I do not notice any charge for capital cost, upkeep, or depreciation in Mr. Moffett's accounts for lighting and heating, but merely coal, coke, firewood, and gas. Yet capital cost must be allowed for, and this with reasonable allowance for upkeep, insurance, and depreciation would be very low at £7 10s. a year. Lubricating oil is not mentioned, though I suppose it is included, and there is no allowance for (*a*) attendance in firing the boiler, (*b*) cleaning up necessary dirt, (*c*) cost of getting coke into cellar and shed. All the above items have to be paid for, either by the work of Mr. Moffett or his domestic staff.

This last month my wife and myself have found that to clean out, lay, and light one extra fire means half an hour's extra work per day, exclusive of coal carrying to the room so heated. In all, even with our small installation, we save £13 a year in domestic help, plus cost of food and breakages, while securing much greater freedom from unpleasant work in running the house.

In the house to which I have removed this month I have arranged to experiment with auxiliary water heating.

I am as anxious as Mr. Moffett is to end the process of destroying all the valuable constituents of coal in order to generate electric power; but I realise that the more electricity is used for all purposes by all people, the sooner will the carbonisation of coal be used to furnish gas and coke to generate electricity.

W. T. Wardale, A.M.I.E.E.

Sheffield, *November 25th*, 1929.

The interesting letter of Mr. F. J. Moffett will no doubt provoke a deluge of replies pointing out the well-known advantages of electricity for domestic purposes other than lighting. Mr. Moffett's costs are not complete, as he fails to debit his gas-coke system with the cost of storage of coke, attention to fires and the removal of ashes. His system also would necessitate resident domestic assistance at least throughout the winter months for attention to the coke-fired boiler. The majority of small post-war residences in suburban areas have, for reasons of cost, the minimum of space for domestic offices; hence the gas-coke system is ruled out in these cases, and can only be applied in more spacious houses where there is ample storage for coke.

The ultimate decision to be reached by informed individuals is whether the unquestioned extra cost of all electric domestic service is worth the great gain in convenience, freedom from dirt, &c. Personally, I think it is worth a good deal to eliminate such a poisonous compound as coal gas.

F. C. Platt.

Birmingham, *November 25th*, 1929.

E.D.A. Salesmanship Conferences.

With reference to Mr. F. A. Dracup's letter in your issue of November 22nd, I should like to point out that the attendance at the E.D.A. Salesmanship Conference on the 15th instant was undoubtedly adversely affected by the appalling weather which was experienced throughout the metropolitan area on that day.

I am sure Mr. Dracup will be interested to know that the attendances at the September and October Conferences severely taxed the accommodation available at the Royal Society of Arts; on both occasions over 200 people were present.

In spite of the fact that we are now in our tenth session of these Conferences, not only is interest sustained, but I am sure that we are increasingly appealing to the younger salesmen in all sections of the industry.

W. A. Vignoles,

Director and Secretary,
BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION, INC.

London, *November 28th*, 1929.

The Refrigeration of Electrical Apparatus.

In 1910 I offered to read a paper on the "Ventilation and Cooling of Electrical Machinery" to the Institution of Electrical Engineers, but it was returned to me. In that paper I dealt with some of the problems raised by Mr. Neu (see ELECTRICAL REVIEW of November 22nd, under the heading of this letter).

I afterwards published the proposed paper in book form ("Ventilation of Electrical Machinery": Whittaker). On page 62, line 12, I wrote: "Oil-cooled transformers of the static type might with advantage use them (refrigerators), &c." I gave figures of approximate cost, &c.

Since that date a great many lengthy and uninteresting papers on this subject have been accepted and published by the Institution.

My book at the time was criticised as though I had been guilty of a criminal offence.

W. H. F. Murdoch.

Sevenoaks, *November 22nd*, 1929.

Two-part Tariff Prepayment Meters.

I have read with interest the description of the "Rex" fixed charge automatic collector and prepayment meter and, as I have been interested in this type of meter since I first saw it in use at The Hague in 1925, I would offer the following remarks on this meter, as compared with the A.E.G. meter which has been on the market for some time.

(1) The "Rex" meter, having only a mechanical device to deal with the fixed charge automatically, cannot do so entirely.

(2) When a coin is inserted, a definite fraction (one half) is commandeered to cover the kWh consumption, even when the fixed charge has *not* been paid.

(3) The A.E.G. meter, on the other hand, has a small constant-speed electric motor connected across the mains, which continuously runs back the prepayment mechanism at the prescribed fixed-charge rate, and this is entirely independent of the current consumption.

(4) The switch in the A.E.G. meter trips the moment the consumer begins to be in arrears of the "fixed charge."

(5) The switch also remains open until a sufficient number of coins is inserted to cover the amount of arrears as shown on the register.

In the whole, the A.E.G. meter strikes one as a miraculous piece of apparatus, especially when the simplicity of the gear is considered.

There is no question in my mind, as Mr. Horwood in his letter in your issue of November 22nd says, that the A.E.G. meter supplies a real "two-part tariff prepayment" meter as near as the human mind can devise.

H. W. Watts, *Lt.-Col.*

Epsom, *November 25th*, 1929.

Standardisation of Sizes of Advertisement Pages.

The following is a copy of a letter that I have addressed to I.S.B.A.:—

"We have noted with pleasure in a number of trade and technical journals in which this company takes advertising space the publication of the I.S.B.A. letter on the subject of the standardisation of advertisement page size. We accordingly write to express our approval of the standards proposed. Whilst we should have preferred only one size, namely, 10 in. by 7 in., we appreciate the difficulties that this would mean to certain publishers, and therefore agree with the proposals that when a larger or smaller size is essential, it should be in the same proportion. The two additional sizes suggested should, we think, meet the requirements for such cases.

"This company feels very strongly that the adoption of standards in advertising space is a reform long overdue. The money spent on designs and blocks of varying sizes is waste which can, and should be, avoided.

"The publishers in the long run stand to gain by the proposals, as by their adoption, advertisers would be enabled to

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cut out the waste expenditure from their allocation and thereby take additional advertising space."

J. Taffs,

Advertising Department,
ENGLISH ELECTRIC CO., LTD.

London, *November 29th*, 1929.

You invite comment on the letter inserted in the REVIEW under the above heading.

As an advertiser, I agree entirely with the suggestion, and look forward to the time when I can use the same size printing blocks in all technical journals; also, as I pay £N for 84 sq. inches of space, I look forward to the obvious reduction to 70/84ths of £N to which I shall be entitled (query mark, fresh paragraph).

The only fly in the proverbial ointment is, will the I.S.B.A. purchase new machinery for the ELECTRICAL REVIEW? Personally, the writer prefers a little larger printing space than that advocated, say, 10½ in. by 7½ in.

J. S. Simmons.

London, *November 29th*, 1929.

[So far I.S.B.A. has given no indication with regard to the provision of new machinery. We hope, however, that trifles of that kind will not deter readers and advertisers from expressing their candid opinions.—EDS. ELEC. REV.]

I cordially endorse the views contained in the letter from the Incorporated Society of British Advertisers. The infinite variety of sizes of technical publications is for advertisers an infinite nuisance. The waste of money on blocks and often on new layouts has been fully emphasised, but it does not even end there. Space has to be found for them, and extra labour is involved in keeping charge of them—three or four blocks being required where one would otherwise suffice. Personally I think 10 in. by 7 in. the most convenient size.

P.p. E. C. Reed, M.S.

London, S.W.1, *December 2nd*, 1929.

Determining Efficiencies by Slide Rule Calculation.

Mr. L. J. Vann's method of determining efficiencies within close limits by slide rule calculations certainly gives very accurate results, but I venture to suggest that the following method, although similar, is of a more simple nature.

$$\begin{aligned} \%\ \text{efficiency} &= \text{output} / \text{input} \times 100 \\ &= \text{input} - \text{total losses} / \text{input} \times 100 \\ &= (1 - \text{total losses} / \text{input}) \times 100 \\ &= 100 - (\text{total losses} / \text{input} \times 100) \end{aligned}$$

The expression Total Losses/Input×100 corresponds to Mr. Vann's expression Y in the worked example.

The efficiency can be read direct from the slide rule without mathematically subtracting Y from 100 by the following method:—

Against the value of the total losses on scale D set the value of the input on scale C, and the per cent. efficiency is read direct on scale D opposite 1 on scale C, by reading from right to left designating 10 as 90 per cent., 9 as 91 per cent., 8 as 92 per cent., &c., 2 would therefore be read as 98 per cent.

If using the values of the losses of the 5,000 kVA transformer as given by Mr. Vann, the working would be as follows:—

		4/4	3/4	2/4	1/4
Load...					
Iron loss	kW	14.0	14.0	14.0	14.0
Copper loss	kW	46.0	25.9	11.5	2.9
Total loss = x	kW	60.0	39.9	25.5	16.9
Output	kW	5000.0	3750.0	2500.0	1250.0
Output + losses = input = y	kW	5060.0	3789.9	2525.5	1266.9
% efficiency (x / y)		98.813%	98.948%	98.99%	98.669%

If the efficiency is below 90 per cent. the above method is employed, but with the exception that, when reading the efficiency on scale D, it is necessary to designate 10 as 0 per cent., 9 as 10 per cent., 8 as 20 per cent., &c.; 2 would therefore be read as 80 per cent.

F. A. Manley.

London, S.W.1, *November 24th*, 1929.

The description of a method for obtaining efficiencies on the slide rule rather different from that given in the ELECTRICAL REVIEW of November 22nd may be of interest to your readers.

By this method, although efficiency is obtained by the setting of the rule, efficiency may be read direct by means of the simple expedient described below. To take a simple, if extreme, case. Let the input be 1,500, and the losses 500, giving, obviously, an efficiency of 0.666 (66.6 per cent.). Against losses (=500) on scale D, set the input (=1,500) on scale C, and we have (1−efficiency) (=0.333) on scale D against the index of scale C.

If, however, we reckon from the *right-hand* end of the scale, taking 1=0, 9=1, 8=2, and so on, we read, at this point, 0.666, which is the efficiency. The mathematical proof of the method is extremely simple and is as follows:—

$$\text{Efficiency} = \frac{\text{Output}}{\text{Input}}$$

$$\text{and } 1 - \text{efficiency} = \frac{\text{Input} - \text{Output}}{\text{Input}} = \frac{\text{Losses}}{\text{Input.}}$$

Losses divided by input is, of course, obtained by the operation described above. By reading from the right-hand end of the scale, we are performing the operation: 1−(1−efficiency), giving efficiency.

Another advantage of the method is that the higher the efficiency, the greater the ease and accuracy with which the result may be read. This is due to the fact that the whole of the D scale may represent any of the following ranges:—(*a*) 0 to 0.9; (*b*) 0.9 to 0.99; (*c*) 0.99 to 0.999, &c. In practice, of course, the range within which the result lies will probably be known, but in cases of doubt, the point can readily be determined by a simple division (Output÷Input) operation.

W. H. Watkins, Grad.I.E.E.

London, *November 25th*, 1929.

[Letters to the same effect have also been received from "Engineer" and "Efficiency."—EDS. ELEC. REV.]

The Countryside and the "Grid."

Much has been written and said on behalf of the nature lover against the erection of the steel pylons carrying the new high-tension electric cables in certain parts of the country, particularly the Sussex Downs and the Lake District, and already some emphasis has been laid on the apparent invisibility of the light, almost spidery-looking structures in comparison with the solid, clumsy, unbeautiful, and in many cases, carelessly arranged telegraph and telephone poles of the Post Office Department. These are allowed to wander aimlessly around the landscape, and even encroach on private property, without regard to the ordinary amenities of appearance. How many of our otherwise beautiful country roads are disfigured by the long monotonous rows of stout wooden poles, with no attempt at camouflage or concealment. In fact the wires wander first on one side and then on the other side of the same road, suggesting a total ignorance of any æsthetic temperament.

But as soon as the Electricity Commissioners startle the ordinary public with their utopian schemes to supply the rural countryside with cheap electricity, every little society is up in arms defending its own particular corner. The pylons themselves cannot be described as ugly, but they are, of course, very obviously not products of nature, and in consequence may not appear exactly as an essential part of the wind-swept pines on the skyline, or the rolling grass-covered expanses of the downlands. The regular spacing which has been adopted is, however, restful, while even at close quarters the long graceful loops of the hanging wires cannot be classed as essentially ugly. At reasonable distances the wires become practically invisible, and the pylons take on a fine delicate outline, suggestive of the tracery of a spider's web.

Some attempts might be made to fit in these essentials to progress with the peculiarly critical outlook of that section of the clamouring public. Experiments might be carried out with varying colour schemes, with a view to discovering the most satisfactory colour for each locality. In some districts the present neutral grey tint is an excellent camouflage, particularly in parts of Derbyshire, and it is at times difficult to detect the distant line of pylons in such places. In others, possibly, a green, or blue shade would be effective. On the other hand, while the horribly mottled effect of the old army camouflage would, no doubt, fit in with certain districts, it is hardly possible that such a scheme would meet with universal approval and would be distinctly disfiguring at close quarters. Again in certain selected areas evergreen shrubs of a suitable type might be planted in a close clump round the base of the pylon. In a few years these would grow, completely blotting out the foundation work, and the lower three to six feet of the structure. The orderly clusters of growing shrubs, even at a distance, would give a pleasing effect, and, by drawing attention away from the upward projecting wrought ironwork of the pylon, assist in further disguising the transmission line.

It is, however, fairly certain that the greater portion of the criticism is a passing phase only, and will have faded into oblivion in a few years' time. Little is heard at present times of the disfiguring effect of the railways, although one has only to look at the sea fronts of some of the North Wales and Devon resorts, to realise how brutally ugly a railway can be made to appear in unsuitable surroundings. It must not be overlooked that some of the criticisms are merely the out-pourings of that section of the community which detests modern progress of

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any kind. One has only to recall Stephenson's witty retort with regard to the trespassing cow to realise that the conscientious objector is always in our midst.

F. E. S.

November 17th, 1929.

I am rusticating—out of sheer necessity, not because the English countryside offers many attractions at this season of the year.

However, I manage to maintain contact with civilisation. I open my newspaper, and a striking headline catches my eye. I read that Germany's exports are increasing by leaps and bounds, whereas ours are increasing only by an insignificant proportion.

What is the reason? Is it our inferior salesmanship, as so many industrial leaders have reiterated so often during recent years? There is no doubt that to a great extent we still adopt antiquated methods, are bound too strongly by tradition, and take refuge too frequently in the optimistic declaration: "We shall blunder along somehow."

Whilst I rusticate I think, and to me it seems that the small village in which I am staying is symbolical of the whole position of British industry. I take up my stick and proceed to amble through this village of under five hundred inhabitants, a typical example of England's gradually dwindling rural population, with numerous thatched cottages above which, in the distance, peeps the tower of the old church. Through the middle of the main street runs a brook, and as I walk along my attention is arrested by a notice nailed to a tarred wooden barn, at a height so that all may see. On a card about twelve inches by eight, written in bold, easily legible handwriting, I read the following with profound interest, having seen something similar in more exalted places:—"Tenders are invited to light the two main street lamps during the ensuing winter. Particulars may be obtained from ———, to whom all tenders should be sent not later than October 31st next."

I look round to try to locate the position of these street lamps, and a vision of the mighty 132,000-volt transmission lines in the county of Bedfordshire springs to my mind. None of these humbugging innovations here! After all, although we may be lagging behind Russia in our electrical development, and although I remember seeing transmission lines strewn over the beautiful panoramas of Switzerland, we must not desecrate the beauties of our countryside. There are limits to which civilisation can penetrate. And I gaze at the two oil lamps which these unæsthetic electrical heathens would utterly destroy. Each lamp is of the conventional glass funnel, oil wick-burning type, mounted on an iron bracket thick with rust, projecting from a dilapidated wooden post about ten feet from the ground. The lamps are about fifty yards apart and close to two wooden plank bridges across the brook, apparently to prevent midnight revellers from toppling into the water. I understand, however, that the lights must be turned out at 10 p.m., and on moonlit nights the lamplighter has a holiday.

Well, here is a position going begging which is undoubtedly a job for life. It has its attractions, and may light the way out of darkness in more senses than one. Even such a post may have its compensations to an electrical engineer with a philosophical turn of mind.

"Tenders are invited . . ." I am seriously thinking of submitting a tender. The fact that it is too late might be a point in my favour!

M. W. S.

November 21st, 1929.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1928.

13,061. "Secondary cells." L. A. Levy and Almeida Accumulators, Ltd. May 3rd, 1928. (321,405.)

13,181. "Railway signalling systems." F. Kruckenberg. May 5th, 1927. (289,894.)

13,308. "Process of and apparatus for the regulation of power-generating installations, more particularly of electric power stations." Askania-Werke Akt. Ges. Vorm Centralwerkstatt Dessau und C. Bamberg-Friedenau. May 28th, 1927. (291,089.)

16,344. "Television apparatus and the like." J. L. Baird and Television, Ltd. June 5th, 1928. (321,389.)

19,938. "Device for protecting transformers, switches, motors, generators, and similar electrical machines and apparatus." M. Buchholz. July 8th, 1927. (293,705.)

19,945. "Electric discharge tubes." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). July 9th, 1928. (321,438.)

20,070. "Method of supporting the armatures of electromagnetic devices such as loud-speakers." G. D. Powell. July 10th, 1928. (321,439.)

20,234. "Television apparatus and the like." J. L. Baird, and Television, Ltd. July 11th, 1928. (321,441.)

21,993. "Electric couplings of the plug-and-socket type." J. A. Crabtree. July 30th, 1928. (321,409.)

22,157. "Volume and tone control systems in electrical sound reproduction." J. W. Cairns and F. A. Thomassin. July 31st, 1928. (321,392.)

22,254. "Electric signalling or indicating apparatus." Relay Automatic Telephone Co., Ltd., British Power Railway Signal Co., Ltd., and J. H. Graham. August 1st, 1928. (321,426.)

23,459. "Electric motors." R. Gold and J. Schmauss. August 2nd, 1928. (321,427.)

22,496. "Electric switch mechanism, and the mounting of such mechanism in boxes, cases, and the like." J. A. Crabtree. August 3rd, 1928. (Cognate application 6,660/29.) (321,428.)

22,650. "Alternating-current electric motors." Lancashire Dynamo and Motor Co., Ltd., and J. W. Howard. August 4th, 1928. (321,393.)

22,728. "Electric motors." H. F. Howells and E. C. Howells. August 7th, 1928. (321,412.)

22,903. "Loud-speakers for wireless apparatus or the like." G. R. Searle. August 8th, 1928. (Addition to 320,654.) (321,430.)

22,967. "Water-cooled vacuum tubes." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). August 9th, 1928. (321,446.)

22,995. "Electric switches." H. T. Logan. August 9th, 1928. (321,449.)

23,022. "Method of fixing heating coils and panels in walls, ceilings, or floors." Benham & Sons, Ltd., and C. R. Allensby. August 9th, 1928. (321,450.)

23,114. "Electrical circuit-interrupters." Associated Electrical Industries, Ltd. August 11th, 1927. (295,397.)

23,135. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and O. A. Pearce. August 10th, 1928. (321,454.)

23,194. "Method of heating the non-metallic covering of electric conductors, such as a single or stranded wire, cables, or the like." General Cable Corporation. August 26th, 1927. (296,085.)

24,125. "Mechanism for automatically controlling the lighting of electrically lighted vehicles." L. Gaston. August 22nd, 1928. (Convention date not granted.) (300,192.)

25,150. "Circuits comprising thermionic valves." General Electric Co., Ltd., and E. P. L. Westell. September 1st, 1928. (321,490.)

25,654. "Signalling systems for giving audible signals." A. Blondel. September 7th, 1927. (296,762.)

26,588. "Push-pull electric switches." L. H. Reid. September 17th, 1928. (321,502.)

26,690. "Electric heaters." G. H. Collins and H. F. Collins. September 18th, 1928. (Cognate applications 26,691/28 and 26,692/28.) (321,503.)

27,776. "Gas-treating devices for enclosed electrical apparatus." A. G. Ellis, H. Diggle and Associated Electrical Industries, Ltd. September 27th, 1928. (321,513.)

28,627. "Fittings for electric lighting and the like systems." P. A. Smith, Dr. O. Faber and Drake & Gorham, Ltd. October 5th, 1928. (321,522.)

28,688. "Reproducer units adapted to be actuated by a gramophone record for producing electrical impulses." Igranic Electric Co., Ltd. October 5th, 1927. (298,209.)

28,848. "Electromagnetic switch." W. Schweitzer. October 8th, 1928. (321,523.)

30,000. "X-ray tubes." British Thomson-Houston Co., Ltd. October 18th, 1927. (298,987.)

30,834. "Ceiling-roses and like electric fittings." W. V. Butterfield, A. W. Butterfield and S. Butterfield (trading as Mycromet Manufacturing Co.). October 24th, 1928. (321,533.)

30,835. "Cord grips for electric lampholders, adapters, and the like." W. V. Butterfield, W. E. Evans, A. W. Butterfield and S. Butterfield (trading as Mycromet Manufacturing Co.). October 24th, 1928. (321,534.)

31,853. "Telephone cables." Siemens & Halske Akt. Ges. May 26th, 1928. (Addition to 284,664.) (312,335.)

32,533. "Electric switches." R. H. Baker and C. W. Parsons. November 7th, 1928. (321,547.)

32,571. "Electric dynamos or motors." J. Lucas, Ltd., E. O. Turner and E. H. C. Robinson. November 8th, 1928. (321,549.)

32,802. "Electrode construction for electron-discharge tubes." Mullard Radio Valve Co., Ltd., and B. Krol. November, 9th, 1928. (321,553.)

33,111. "Thermionic amplifier circuits." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). November 12th, 1928. (321,560.)

33,182. "Apparatus for maintaining a constant speed of electric motors." G. A. Cox. November 13th, 1928. (321,562.)

34,904. "Method of and means for cleaning the electrodes of electrical gas-cleaning apparatus." Lodge-Cottrell, Ltd. (Metallges. Akt. Ges.). November 27th, 1928. (321,571.)

1929.

481. "Control of prime mover plants." British Thomson-Houston Co., Ltd. January 5th, 1928. (303,525.)

935. "Electric reversing switches." Scintilla Akt. Ges. March 1st, 1928. (307,012.)

1,304. "Lighting-device for vehicles." G. F. Blanchod. January 14th, 1928. (304,143.)

1,808. "Regulating transformers." International General Electric Co., Inc. January 18th, 1928. (304,290.)

2,950. "Micro-telephones." H. N. Skerrett (Fuld & Co., H., Telephon- und Telegraphenwerke Akt. Ges.). January 29th, 1929. (321,612.)

4,182. "Direction-finding radio apparatus." Telefunken Ges. für Drahtlose Telegraphie. February 8th, 1928. (305,632.)

7,056. "Synchronous reproduction of picture films and disk sound-records." C. H. Verity. August 13th, 1928. (Divided application on 318,847.) (321,624.)

11,955. "Electric transformers." British Thomson-Houston Co., Ltd. April 18th, 1928. (309,955.)

14,411. "Mercury electric switches." Dr. P. Meyer Akt. Ges. May 8th, 1928. (311,293.)

23,778. "Electric signalling or indicating apparatus." Relay Automatic Telephone Co., Ltd., British Power Railway Signal Co., Ltd., and J. H. Graham. August 1st, 1928. (Divided application on 321,426.) (321,415.)

27,232. "Switch-fuse." C. W. Cox and C. E. C. Shawfield. June 9th, 1928. (Divided application on 320,356.) (321,463.)

32,158. "Electric switch mechanism, and the mounting of such mechanism in boxes, cases, and the like." J. A. Crabtree. August 3rd, 1928. (Cognate application 32,159/29.) (Divided application on 321,428.) (321,416.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from November 27th:—

Celestrola. No. 502,917. Class 8. Instruments and apparatus for signalling, and parts thereof, &c.—Celestion, Ltd., 145a, London Road, Kingston-on-Thames.

Oscillophragm. No. 503,122. Class 8. Radio-telephonic loud-speakers.—Graham Amplion, Ltd., St. Andrew's Works, Slough.

Trojan Electric Recording. Made in England (lettering and design). No. 506,762. Class 8. Radio-telephonic apparatus and parts thereof, &c.—British Homophone Co., Ltd., 67-69, City Road, E.C.1.

Maxiphone. No. 506,871. All goods in Class 8, with certain exceptions.—Lugton & Co., Ltd., 133-135, Old Street, E.C.1

Dexite. No. 503,217. Class 50. Battery cases and parts thereof, electric light standards, insulators (electrical), &c.—British Xylonite Co., Ltd., Hale End, Essex

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New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

BEESTON.—Houses (130) for the U.D.C.; surveyor.

BEXHILL.—House, Haddocks Hill; E. Bunce.

BLACKBURN.—Cinema, Audley Lane, for A. G. Wilson, West Kirby, Liverpool; Gray & Evans, 51, North John Street, Liverpool.

BOLTON.—Cinema, Bark Street; W. & S. Bradley, architects.

BRENTFORD.—Improvements, Court House (£15,687); Fassnidge & Sons, Ltd.

CARSHALTON.—Church, for the Baptist trustees; secretary.

CHESTER-LE-STREET.—School (448 places), and dining hall, secondary school, for Durham E.C.; F. Willey, architect, 34, Old Elvet, Durham.

CHORLEY.—Pump House, Lower Healey Bleachworks; J. T. Holt, Ltd.

CROYDON.—Houses (36), Falkland Park Avenue; P. Richardson. Alterations and additions, 39-47, North End; Batchelor & Son, Ltd. Alterations, 19-21, George Street; John Barker & Co., Kensington. New schools and rebuilding of Beulah and Oval Road schools for the Borough E.C.; A. Sunderland and J. M. Sheppard, architects.

DUNDEE.—Reconstruction of Her Majesty's Theatre as cinema (£35,000); the manager. Reconstruction of La Scala Picture House; the manager.

EASINGTON COLLIERY (Co. Durham).—Re-erection of miners' hall, and cinema, for the Miners' Lodge; G. W. Bloomfield, secretary (£9,000).

EAST LOTHIAN.—Police stations at Prestonpans (£3,993) and Tranent (£3,810); county clerk, Haddington.

EASTRY (Kent).—Additional 118 houses, for the R.D.C.; surveyor.

EPPING.—Remodeling church schools, for the managers; J. Stuart, architect, Springfield Old Court, Chelmsford (returnable deposit of £1 1s.).

FARNHAM ROYAL.—Senior school and extensions, junior school, for Bucks E. C.; education architect, Aylesbury.

FAVERSHAM.—Business stores, Market Street, for F. W. Woolworth & Co., Ltd., Kingsway, London.

FENTON.—Houses (61), Vivian estate (£20,949); C. Cornes and Son, Hanley.

FOLKESTONE.—Five schools for the Borough E.C. (£62,917); director of education.

GLASGOW.—Buildings, Sauchiehall Street, for Bank of Scotland; the manager. Extension of cinema, Wellshot Road; George Green, Ltd. Extension of Larchfield garage for Corporation; general manager, Municipal Transport Department.

GOLBORNE.—Junior and infants' County school (£23,000); county architect, 16, Ribblesdale Place, Preston.

GRAVESEND.—Houses (170) Players site. School (600 places), King's Farm estate, for the Borough E.C.; J. G. Bennett, borough architect.

GREAT PRESTON.—School (730 places), for West Riding E.C.; J. C. McGrath, clerk, Wakefield.

GUILDFORD.—Alterations and additions, 104 & 67, Quarry Street; W. H. Smith & Son, Ltd.

HALSTEAD (Essex).—Additional 30 houses, for the R.D.C.; surveyor.

HAREFIELD.—Reconstruction, Sanatorium; Middlesex County Architect and Medical Officer of Health.

HAYDOCK.—School (£36,000); county architect, 16, Ribblesdale Place, Preston.

HOVE.—New school at The Knoll, and extensions to Connaught Road and East Hove schools (£37,970), for the E.C.

LANGHO.—Extensions to institution for the Lancashire Asylums Board (£90,000).

LEICESTER.—Houses, Braunstone estate; W. & H. Foulds (86), S. A. Potter (16), J. Freer (46), and Bodill and Sons, Ltd. (108). Elementary school, Imperial Avenue. Buildings for Newarke secondary school, Braunstone estate; Education Committee. Education offices, Newarke Road (£14,760); Bowles & Sons.

LIVERPOOL.—Re-housing scheme, Burleigh Street and Great Richmond Street housing scheme (256), Norris Green estate; land steward and surveyor, Municipal Buildings, Dale Street. Church at Norris Green estate; Dr. David, Bishop of Liverpool.

LLANDRINDOD WELLS.—Post office for H.M. Office of Works, King Charles Street, London, S.W.

LONDON (Stepney, E.)—Five blocks of tenements, Limehouse Fields; borough engineer.

(East Ham, E.)—Extensions, isolation hospital (£42,156) for the T.C.; borough engineer.

(Poplar, E.)—Flats (120), Bow Brewery estate; borough engineer. Factory, Bow Road; D. H. Klausner, 21 Finch Street, E.C.

(Finchley, N.)—School (400 places), Woodhouse estate for the E.C. Bank, Hill Rise and Lyttleton Road; National Provincial Bank, Ltd.

(Deptford, S.E.)—Technical institute for L.C.C.; Albert Monk, Lower Edmonton. Blocks of shops, for the London C.C.; superintending architect.

(Chiswick, W.)—Factory at corner of Great West Road and South of Boston Road; Moore & Cadley, architects, Bradford.

(Hammersmith, W.)—Central school, Wormholt estate (£17,950); Albert Monk, Edmonton.

MANCHESTER.—Laundry, adjoining Moss Side public baths (deposit, £1 1s.); city architect, Town Hall.

MARGATE.—School of art, for Kent C.C.; W. H. Robinson, architect, Springfield, Maidstone (returnable deposit of £2 2s.).

MELKSHAM.—Housing scheme (30), for the U.D.C.; surveyor.

MIDDLESBROUGH.—Re-erection of joinery works, North Ormesby, for Proudlock, Moore & Co.

MILTON REGIS (Kent).—Additional 100 houses, for the U.D.C.; surveyor.

MUSSELBURGH.—Grammar school (£50,000); Master of Works, Midlothian Education Authority, Edinburgh.

NEWPORT (Salop.)—Housing scheme (60), for the U.D.C.; surveyor.

PONTEFRACT.—Two schools (870 places), for the Borough E.C.; F. M. Farmer, clerk.

PRESTON.—Four elementary schools for the E.C.

PRESTWICH.—Offices and canteen at mills, for Waterdale Dyeing and Finishing Co., Ltd.; T. A. Fitton & Son, 19a, Corporation Street, Manchester.

RAMSBOTTOM.—Conversion of Co-operative Hall to cinema, for the Ramsbottom Co-operative Society; A. Winstanley, architect, 15, Ducie Street, Manchester.

RUNCORN.—Housing scheme (34), Helsby, for the R.D.C.: surveyor.

STOKE-ON-TRENT.—Seven shops and offices, Church Street (£13,590); Ball & Robinson.

STROUD.—Central school, Downfield (£13,000), for Gloucestershire E.C.; director of education, Gloucester.

SWADLINCOTE.—Additional 90 houses, Midway, for the U.D.C.; surveyor.

TOLWORTH.—Church, for St. Raphael's R.C. Church, Kingston-on-Thames; priest-in-charge.

TYNEMOUTH.—Development of Manor estate; S. Oswin's Estate Co., Ltd. Extensions, Moor Park Hospital; borough engineer. Alterations and additions, Saville Street and Little Bedford Street; F. W. Woolworth and Co.

WEDNESBURY.—Reconstruction of King's Hill school and two new schools, for the Borough E.C.; director of education.

WHITBURN.—School (650 places), for Durham E.C.; F. Willey, architect, 34, Old Elvet, Durham.

WHITWOOD (Yorks.)—Houses (56), for the U.D.C.; Gallagher & Son, builders.

WINCANTON.—Additional 100 houses for the R.D.C.; surveyor.

WISBECH.—Post office and telephone exchange, for H.M. Office of Works, King Charles Street, London, S.W. (returnable deposit of £1 1s.).

WOKINGHAM.—Girls' secondary school (£15,000), for Berks. E.C.; director of education, Reading.

WORKINGTON.—Central school (500 places), for the E.C.; director of education.

YORK.—Two schools for the City E.C.; P. J. Spalding, clerk.

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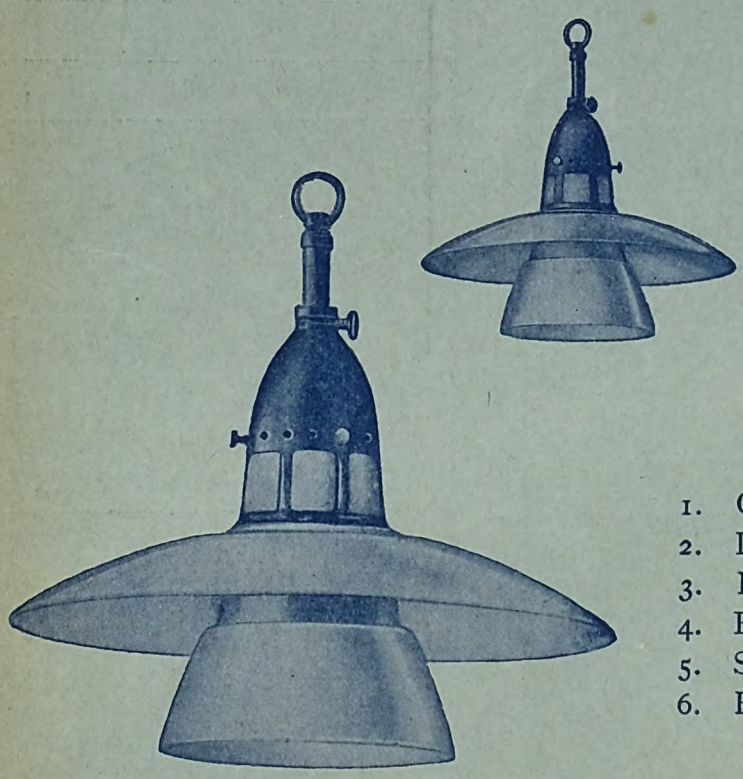

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For List of Foreign Agents for the ELECTRICAL REVIEW see Advertisement Supplement.

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A Call for Optimism.

READERS of this journal do not need to be reminded that again and again we have deprecated the disposition of British writers and orators to magnify our shortcomings and thus spread about the world the stupid idea that as an industrial and financial people we are "down and out."

Several years ago a president of the Federation of British Industries came back from a visit to the U.S.A. and warned us that great harm was being done by our excessive introspection and our readiness to accept other people's judgment of our action or inaction. That gentleman is a member of the Education for Salesmanship Committee, whose interim report was reviewed in our last issue. A few days ago the Federation issued a weekly letter to the Press pleading for more optimism and condemning the willingness of our people to stress our failures and to broadcast criticisms of the inefficiency or lack of initiative of our manufacturers. Though we are emerging with "a very reasonable show of success from a long and bitter struggle with trade depression," we "bemoan the fact that we are losing ground in our export markets and blame our salesmen. We advertise the number of our unemployed and draw dismal deductions from their total." Contrasting this attitude with that of others, the Federation finds U.S. experts indulging, in the time of American trouble, in "a doubling of her export of optimistic propaganda."

America is stated to be making a great drive for a "prosperity offensive," and her experts predict new production records next spring. Not all the reports that reach us, however, are quite so convincing on that matter, but we join with the Federation in its appeal to British observers to make the most of our causes of optimism. We have had great economic difficulties in our path and cannot do other than remember them and contrast them with the easier situation in the States prior to the slump. We have also to remember that the British temperament has its drawbacks—if we belittle

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ourselves what wonder if overseas customers accept us at our own valuation? Business men resident in the Dominions have asked the Federation to draw the British public's attention to the very real injury that is done to our interests overseas by the dissemination of news calculated to give a gloomy picture of the state of the Mother Country. Parenthetically, may we remark that the world is also too ready to accept American interests at their own valuation. It might help matters to some extent if some of our experts were to investigate and write frankly regarding the industrial failings that are to be met with in America.

There are very definite signs that the future of the British electrical industry is likely to be very great indeed. Export trade figures at this moment are showing that outside of this country we are not by any means "down and out" electrically. Certainly British electrical manufacturers are not blindfold—they can see what is going on and they know their business. But we have a surplus electrical manufacturing capacity in these islands and could produce vastly more than we are doing at present. Increase the Home demand on our factories, and we shall produce more cheaply and expeditiously, and so become still better able to impress the overseas buyer.

Of course there must be a reasonable limit to our optimism; it is not entirely justifiable unless it is based upon facts and upon reliable signs. Whether we speak electrically or generally can we be expected to be overflowing with optimism if we have to keep one eye on our legislators at Westminster, are constantly in fear of new financial burdens, and are noting weekly increases in our unemployment figures?

The valuable publication issued by the B.E.A.M.A. and summarised in our last two issues contains a mingling of optimism and pessimism. In some of its parts it should promote joy in the heart of the young electrical engineer to know that he is connected with an industry which has so glorious a future. It tells of the approach of the time when our basic industries will be able to go ahead and make up the leeway in the electrification of their works and factories, but it looks some distance before it sees railway electrification and rural electrification yielding much business.

While describing Europe as the world's best market for electrical manufactures to-day, it tells us that America and Germany have demonstrated their ability to secure increased foreign trade there in telegraph apparatus and some other lines of the small mass-production classes, because they are outside the particular aptness and interests of the British manufacturer. Let us, however, not be too resigned to the continuance of such a state of things. America is also stated to be winning trade in Europe because of financial penetration and the ownership of subsidiary organisations. Here we may not find ground for excessive cheerfulness, but the effect of foreign capital investment has various ways of working out. Further, we have a great Empire with vast resources, and sooner or later great opportunities for electrical trade, a thought which should at least check our pessimism. On the other hand, we hardly think that the F.B.I. would have us fall upon each other's necks over the Australian tariff question and the dispatch of another Australian Trade Minister to these shores to induce our manufacturers to build works in Australia instead of exporting the products of our workpeople in home factories.

The B.E.A.M.A. book, after gladdening our hearts by reporting the fact that we have regained our strong competitive position, leads us, as we stated last week, into a future where there is "doubt tinged with a kind of desperate optimism." It tells us, as has been already recognised, that the reparations policy of payments in kind has operated against our industry, a thought which recalls the fact that such a disastrous policy was not permitted directly to affect the electrical industry of this country when it was proposed, some years ago, that super-power stations and electric railways for Britain should be provided by Germany direct. What we have endured is bad enough, but is it not small compared with what we then escaped? Any Government having, or affecting to have, the increase of British productive employment at heart will favour the continuance of the policy so far carried out by the Central Electricity Board of securing British power station and other electrification contracts to British factories and British workpeople. How could it consistently do otherwise? Whereat the temperature of our optimism rises considerably, though we still have to keep an eye towards Westminster.

Engineering and Financial Statistics.

TOWARDS the end of last week the Electricity Commissioners issued a new volume of their admirable publication entitled "Return of Engineering and Financial Statistics relating to Authorised Undertakings in Great Britain" (Stationery Office, 12s. net). The present publication relates to the year ended December 31st, 1927, as regards companies, and March 31st, 1928, as regards municipalities, the previous volume (1926-27) was completed so recently as last June, and, as the collating and analysing of statistics on so large a scale clearly involves a large amount of work, the issue of the new edition in a comparatively short space of time appears to indicate that the staff of the Commissioners is free from much of the work involved in the preparation of schemes for the Central Electricity Board and is now able to devote its attention to the more normal requirements of the electricity supply industry. We have on previous occasions commented upon the depreciation in value of these returns consequent upon their late appearance and hope that the noticeable improvement made lately will continue, as even the present volume is surely quite twelve months overdue.

We have suggested recently that the scope of these returns should be extended to cover an analysis of the consumption of electricity in the areas of the different undertakings, in such a manner as to indicate the state of development among different classes of consumers consequent upon the adoption of tariffs with low secondary charges and adequate hire or hire-purchase schemes. Valuable to the whole electrical industry as such particulars would be, however, we think it would be still more desirable to concentrate attention for the time being on the publication of figures on existing lines as soon as possible after the end of the year to which they relate.

As to the contents of the volume before us, we find that during the year under review the number of kWh sold increased by 19 per cent. to approximately seven millions, representing a consumption of 158 kWh per head of the then estimated population, with a maximum demand and connected load per head of 85 and 203 watts, respectively. It must be remembered, however, that the previous year had been one of depression due to industrial trouble and that much of the magnitude of the increase is due to recovery from abnormal conditions. Of the output by authorised undertakings, 64.3 per cent. was sold for power, 24.9 per cent. for lighting and domestic purposes, 9.2 per cent. for traction, and 1.6 per cent. for public lighting.

Approximately two-thirds of the output from 490 power stations was provided by public authorities and one-third by companies. The capital expenditure amounted to some £269,000,000 (£6 per head of population), being £51 per kW of generating plant installed. Of that expenditure 41.4 per cent. was on account of generation and 58.6 per cent. on account of transmission, distribution, &c. Capital expenditure during the year amounted to £30,000,000, or 13 per cent. more than in 1926-27. The total revenue amounted to £53,000,000 (an increase of 6 per cent.) and averaged £18 per £100 of capital expenditure, excluding inter-sales of electricity in bulk. That revenue was equivalent to 1.49d. per kWh sold, as against 1.71d. for the previous year.

Working expenses (including bulk supplies purchased) absorbed 56 per cent. of the revenue, compared with 66 per cent. in 1926-27. The cost of generation accounted for 39 per cent. of the total figure.

These figures are distinctly better than those of the previous year, but—as stated above—much of the difference is accounted for by the industrial troubles of 1926. Nevertheless 1926, in spite of such adverse factors, was itself better than any previous year.

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Allocation of Costs of Production.

Two important regulations made by the Electricity Commissioners under the 1926 Act are noted elsewhere in this issue. They relate to the allocation of the cost of production at selected stations and its adjustment according to power factor. The correct allocation of costs to fixed and running components is one of the most important factors in determining the financial balance between the Central Electricity Board and the owners of selected stations, and to devise formulæ for general application is a work involving considerable technical skill and knowledge of operating factors. So far as we have been able to check the figures, they appear to meet, within reasonable limits, conditions that are likely to arise in practice, and it is undoubtedly a distinct gain to have a standard method of ascertaining easily what the proportions of fixed and running costs will be in any given case.

The Radio Manufacturers.

THE annual dinner of the Radio Manufacturers' Association was held on Wednesday last week; on the following day the annual meeting took place. The meeting showed a remarkable degree of unanimity, a circumstance which appears to justify the juxtaposition, and order, of the two events.

The principal theme at both functions was, naturally, the recently-concluded agreement with the Marconi Company upon the question of royalties. Mr. F. Kellaway, speaking at the dinner, pointed out that while manufacturers might consider the terms of the licence not altogether satisfactory, they were such as to provide a considerable amount of protection from foreign competition.

At the annual meeting Mr. J. T. Mould, the chairman, stated that the agreement with the Marconi Company represented the minimum obtainable and members were free to negotiate better terms if they could. One or two members were inclined to wonder how individuals could succeed where the Association had failed. Mr. Mould considered that the best terms had been obtained in the short time available, but hinted that the Association was not bound to remain acquiescent.

The raising of the question of "price-cutting," an evil particularly rife in the radio industry, did not bring forth anything very definite. The chairman mentioned, however, that the wholesalers and retailers had together approached the Association with regard to this matter. Can it be that these three bodies hope to secure by negotiation what it was found impossible to effect by direct association?

One of the many interesting points in the annual report is the statement that it is not considered feasible to form a benevolent fund for the radio trade. The E.T.B.I. is to be asked to extend its wings to cover the industry. No doubt the Institution already has many members in the manufacturing and wholesaling branches, but the extension of its activities to the whole of the retailers (who in many cases have no real electrical experience) is a matter for very serious consideration.

Co-operation Between Supply Undertaking and Factory.

IT is often stimulating to diverge from the beaten track, and in this connection we have in mind the electricity supply organisation of the Staveley Coal and Iron Co., Ltd., to which we refer elsewhere in this issue. The undertaking is non-statutory, and, of course, its main purpose is to supply electricity for the various activities of the company; but the supply of something like 20 million units per annum to 7,000 consumers suggests an important public supply undertaking.

The real interest in the Staveley concern, however, from the electricity supply engineer's point of view, lies in the combination of works supply and public supply, together with the fact that practically the whole of the output, 70 million units, is produced by the use of waste heat from what may be described as the manufacturing side of the company. The result is that the undertaking is able to supply electricity, while making a reasonable profit, at the particularly low average figure of 0.55d. per unit. Another feature of the concern which has helped considerably in attaining the above result is the fact that, by using a large proportion of its own load to fill the valleys, it has been able to produce a load curve representing a factor of about 70 per cent.

These figures should, we suggest, be given great consideration by all interested in the electricity supply industry. The ordinary supply undertaking, of course, has no such advantages as those pertaining to the Staveley concern, but could not the principle of co-operation between the two branches of the company, manufacturing and electricity supply, be applied in the broader sense as between the manufacturer and the supply undertaker? The suggestion, we assert, in view of the importance of the Staveley figures, is not one to be turned down as impossible without consideration of its possibilities.

The activities on the manufacturing side of the company in question are very similar to those of numerous concerns throughout the country in which no use whatever is made of waste heat, and the power requirements of the same branch of the company are also very similar to those of numerous manufacturers who run their motors on the peaks of the supply undertakings.

More About Russia.

SOVIET Russia remains an unknown quantity in spite of all that has been written during the past nine years. We have done our best to keep our readers acquainted with the situation of the country as it affects the electrical industry and the article by Dr. Segal which appears in this issue is only the latest of a long series. It is evident from this article that the Soviet Government realises the value of the electrification of industry, for much of the plant now being installed is designed to supply energy to factories and works. The figures given show a remarkable electrical development and prove that economic necessity stimulates rather than retards electrification.

Dr. L. Segal claims that by the end of the current financial year the capacity of electric power stations in Russia will be treble the pre-war figure, while the output of these will be over four-and-a-half times the output in 1913. He also says that the huge sum of £70,000,000 is to be spent on electrical construction in the current financial year; a large proportion of the plant involved must of necessity be imported and therefore the opportunities for electrical manufacturers would appear to be good. We showed in our last issue that the Russian imports of electrical machinery and apparatus in 1927-28 were valued at 46½ million roubles (about £4,650,000) representing an increase of about 90 per cent. on the 1926-27 total. At the same time it was stated that the imports represented only 29.7 per cent. of the total sales, which seems to point to a large home production, aided no doubt by "imported" foreign experts and ideas. Although in 1927-28 Germany's share declined, it was still more than half; this is attributed to a credit of 30 million marks provided by Germany. The participation of Sweden and the United States was also substantial and this may be assumed to be due to a great extent to the above-mentioned technical assistance of which we have made mention on several occasions. America is still pursuing this policy if a recent Moscow message is to be credited. This says that the Russian Trading Delegation in the United States (the "Amtorg") is negotiating with the American General Electric Co. with regard to the delivery of further electrical manufactures. Last year (as we reported at the time) an agreement was entered into between the company and the Soviet Government for the supply of products of the value of $26,000,000. The present negotiations concern the delivery of goods valued at $4,000,000 for electrical works in Siberia. It is also reported that the Soviet authorities have admitted a group of 37 American engineers for work in the power stations in Eastern Siberia.

All these considerations should be borne in mind during the negotiations which are to follow the recent exchange of ambassadors between this country and Russia. There is undoubtedly business to be done if satisfactory terms can be arranged.

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Electric Lighting on Small Tugs.

The Case for the Use of Electricity and some Notes on Installation Work.

By A. F. BEACH.

THERE are many important points in connection with the installation of electric lighting on board small steam tugs which are likely to be unforeseen by a contractor who has had no previous experience of this kind of work.

The craft referred to has a cabin at each end, the intervening space being occupied by the boiler and engine, the former taking up practically the whole width.

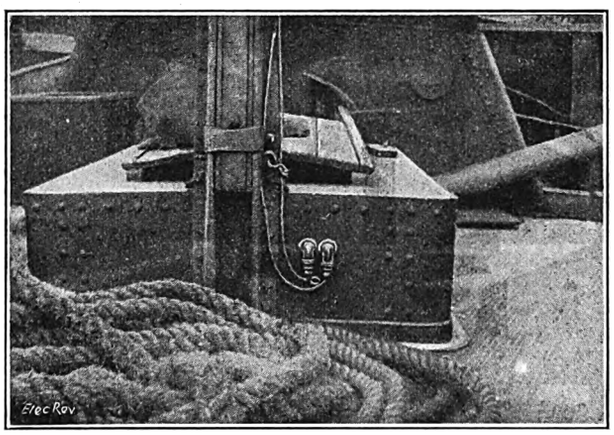

Fig. 1.—Position of Plugs for Mast Light.

Perhaps the greatest advantage gained by the use of electricity for lighting is due to the fact that the top mast light can be switched on and off immediately from the wheel box. It should be explained that a tug shows three lights when under way alone: a white light on the mast, a red light on the port side, and a green one on the starboard side. When towing, two white lights are carried on the mast, one vertically above the other, and not less than four feet apart; the masters of other vessels are then aware that they cannot cross close astern. It will be seen that any delay in showing this extra light, after picking up a tow, may be, and in fact often is, the cause

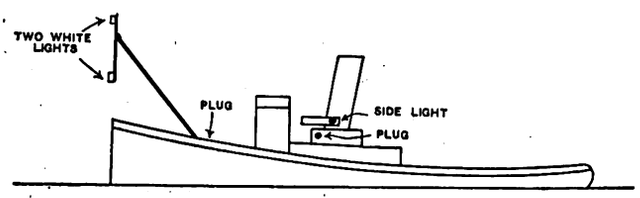

Fig. 2.—General Lighting Arrangements.

of a collision, involving repairs, the cost of which may far exceed the cost of the electrical plant. The installation must be as robust and reliable as it is possible to make it, as it will not receive a great deal of care, and probably no skilled attention until absolutely necessary. It will also be subject to extremes of temperature, to moisture, vibration, and frequently heavy jars.

The lighting set will, of course, be directly-coupled steam-driven, and should be fixed with the shaft running fore and aft, as, although these small tugs are unlikely to encounter rough seas, they are easily set in motion, and roll at a fairly high frequency. The small set, with a fly wheel heavy in proportion, is run at a good speed; this combination would allow comparatively large gyrostatic forces to come into play, if the set were placed with the axis of the shaft across the ship. It is essential that the engine should be arranged to exhaust either into a condenser or the atmosphere, the former not only for the sake of efficiency, but also for economy of water, as there is usually little reserve in hand, and it is sometimes not easy to obtain when required. It is not advisable to evaporate more river water in the boiler than necessary, as the water in reaches where tug boats are used frequently contains many and varied impurities. A two-way cock must, however, be provided to enable the exhaust to be turned to atmosphere when the main engine is not working, as the condenser pump will then also be out of action.

Fifty volts has been found to be a very satisfactory pressure; this is not a matter of great importance, but the greater strength of the filament of a lower-voltage lamp is one advantage. The switchboard, which should be fixed in the most convenient position close to the lighting set, should be as compact and simple as possible; a teak board constructed of battens and containing only the barest necessities is all that is required. It is possible that the omission of a voltmeter and even of a shunt

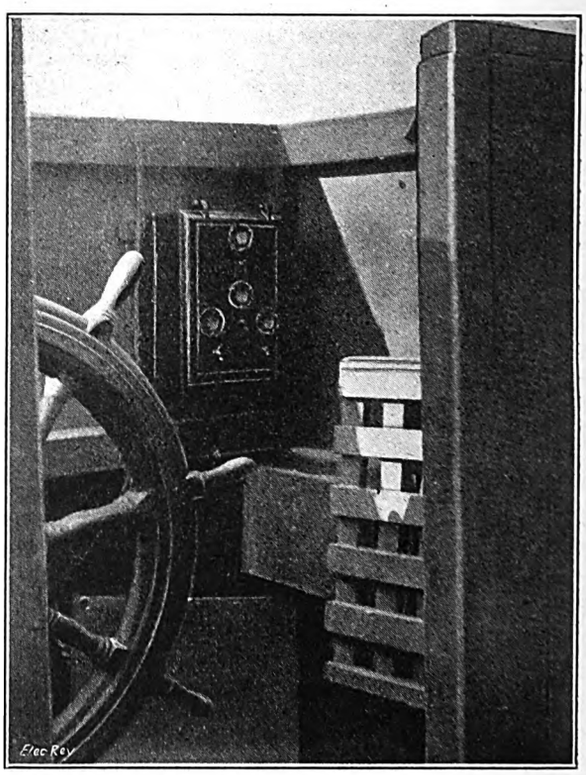

Fig. 3.—View of Wheel-box Switchboard.

regulator (employing a fixed adjusted resistance in lieu thereof) would not cause dissatisfaction, as the load is practically always the same, and the engine governor ensures better regulation than is necessary. A socket for a portable hand lamp should be provided, and, as

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this will probably be left on in any case, it can be utilised to light the water gauge, the flexible being suspended on hooks so that the lamp can be easily removed when required elsewhere. Plug sockets should be provided so that this lamp can be used for inspection purposes anywhere, and it is sometimes very useful on deck. It is not necessary to connect switches for the lamps below deck, as all the lights are usually left on while the set is running, the after cabin being perhaps an exception where the light may be put out when an opportunity occurs during night work for any of the crew to sleep. The distribution board should be fixed in the most accessible position where it is not in the way in the engine room. A satisfactory board can be made of a base of a material which is unaffected by heat and moisture, and preferably not brittle, on which porcelain cut-outs are mounted; it is not advisable to use spring clips or glass doors.

The wiring is the next consideration. In the engine room and cabins, twin lead-covered wire supported at frequent intervals makes a very satisfactory job: it is easy and not expensive to install, and any unsightliness caused by sagging is not of great importance. The disadvantage that this wire is liable to injury is largely counterbalanced by the fact that, owing to its flexibility, there is no difficulty in fitting it snugly out of the way into the corners and round the awkward contours that will be encountered, and, if damage does occur, it is most likely to be in the most exposed position, and therefore in full view and accessible for repair.

To reach the fore cabin and wheel box, and possibly back to the side lights, the wiring must be carried past the boiler, and the choice has to be made between running within the boiler space or outside. In the first case, there are the objections that the temperature may be very high and the space almost inaccessible, probably entirely so when the boiler is hot, and, in the alternative, that the wiring is exposed not only to the severe weather conditions, but also to great risk of mechanical injury. Which is the lesser of the two evil ways depends upon the size and type of craft, but, if it is possible, it is advisable to carry the wiring inside. In either case it must be borne in mind that a repair may be required in haste, and while the tug is working. For this portion of the wiring, either inside or out, it has been found satisfactory in practice to use solid-drawn galvanised steel tube, each tube containing one twin c.t.s flexible cable for each circuit. The runs should be kept as straight and free from bends as possible, and the tubes of ample size, so that a new lead can be drawn in from end to end. The ends of each tube run should be taken into a junction box with porcelain interior; the opposite side of the box to the tube entrance can then be fitted with a nipple and bush to take the lead-covered wire to continue the circuit.

Each of the four leads from the wheel box switches which feed the navigation lights should end in a fixed metal socket, a twin c.t.s. flex connected to each of these lights having a plug at the other which fits this socket. These plugs and sockets, being outside and exposed to all weather conditions, should be the best obtainable for the purpose, and the socket should be provided with a metal cap cover when the plug is withdrawn. The sockets would be fixed on the hatch combings and connected from behind, so that the wiring is all inside. The two leads for the mast lights would be attached to the mast by saddles, but it is sufficient for the side lights to be twisted round the iron stanchions; it is in either case easy to renew this exposed portion of the work, as it is not necessary to interfere with the protected wiring up to the socket.

It is frequently necessary for a tug to lower her funnel and mast when passing under a bridge, and it is essential that she should still show correct lights. To accomplish this, the two mast lamps should be carried on a vertical spar suspended above its centre to the top of the mast and pivoted near its base, and the whole so arranged that when the mast is lowered (forward) the two lights would still show over the bow in the same relative position. The c.t.s. flex must be given a complete loop at the pivoting points, and sufficient slack at the base of the mast to allow this movement to take place without tightening the flex.

It will often be found that tug owners have not sufficient faith in electric lighting to rely entirely upon it for the lights above deck, and, wisely, perhaps, prefer to keep oil lamps ready in case of emergency. Facilities must, therefore, be made for changing quickly from one to the other. There should be no difficulty in designing a simple fitting to which the lampholder is fixed, to fit inside the side light lanterns in such a manner that it can be immediately withdrawn with the attached flex, and an oil lamp substituted. It is not as easy to adapt the mast lamps in this manner, as the flex is attached to the mast by saddles. The old mast with oil lamps complete is, therefore, sometimes kept as spare, and entirely new gear provided for the electrical equipment.

The switchboard in the wheelbox calls for special attention. It should be mechanically strong and weatherproof, even while the switches are being operated, but all parts should be easily accessible. An arrangement, which has been found to be entirely satisfactory, consists of a cast-iron case with cover hinged at the top, which makes a water-tight joint when closed and tightened by a fly-nut. Within is a board of non-hydroscopic insulating material, fixed by screws to two battens of the same material, so as to allow ample space behind it for the incoming leads and connections. On the front of this board are four switches fixed in the same relative positions as the lights which they control, *i.e.*, one at the top in the middle for the top mast light, one vertically beneath for the mast light, and one on each side at the bottom for each side light. When the cover is closed, each switch is operated from outside by means of a spindle passing through the cover, the outside lever on the end of the spindle being in a vertical position when the switch is on and horizontal when off. Four miniature batten holders are fixed on the board inside for pilot lamps, one above each switch and connected in series with it, a glass window in the iron cover coinciding with each lamp. These windows are made of plain ground glass, and the two at the bottom have also red and green glass for the port and starboard lights respectively. These lamps are screened from each other by sheet brass partitions to prevent a window being illuminated by any but its own lamp. Thus, a facsimile of the tug lights is in full view of the steersman, so that he can assure himself that the correct lights are showing, and is made immediately aware of the failure of any of them.

The pilot lamps are at low voltage, and selected of such a size that they require a slightly larger current to light them fully than they will get when connected as above; if, for instance, the navigation lamps are 30 W on a 50-volt circuit, the pilot lamps might be 2 W at 3 volts (metal filament). They are thus underrun, which tends to increase their life, and allows them to give a slightly more subdued light, this being an advantage, as anything brighter than the merest glimmer is sufficient to cause a blinding effect on a dark night. A short-circuited adaptor is attached to each pilot lampholder to replace a burnt-out lamp, should a spare not be at hand.

These notes refer to installations in the smallest type of these craft, such as are to be seen in numbers on any of our water highways. The equipment of larger vessels presents no particular difficulties, as the conditions are more nearly those of an ordinary shore installation.

Apart from the facility of switching on the towing light, it might appear a superfluous luxury to fit such small vessels with electric lighting, but the great improvement in the engine room illumination and the convenience of a portable hand lamp for the inspection of out of the way mechanism must tend toward higher efficiency, and eventually considerably affect the maintenance costs, although this might not be immediately apparent.

The steam used for the tiny set (about 300 to 350 watts) is almost negligible, and the difference in coal consumption certainly not noticeable, but the reduction almost to vanishing point of the cost of oil lamp and lamp glass repairs and renewals, a surprisingly heavy item, and of the cost of lamp oil is at once evident.

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The Staveley Coal and Iron Co.

Some impressions of a visit to a few of the company's works and collieries where electricity is economically generated and extensively utilised for coal winning and the manufacture of by-products, and also distributed for public supply purposes.

PUBLIC electricity supply has been so much in the limelight in the past few years (and quite rightly so) that what is being done in the way of electricity supply by private concerns has probably come to be regarded as of minor importance. The importance of such work, however, is illustrated by the activities of the Staveley Coal & Iron Co., Ltd., near Chesterfield, which might be described as a large generating and distributing undertaking, as well as a large coal-producing and manufacturing concern, in which sense it is a very large power consumer.

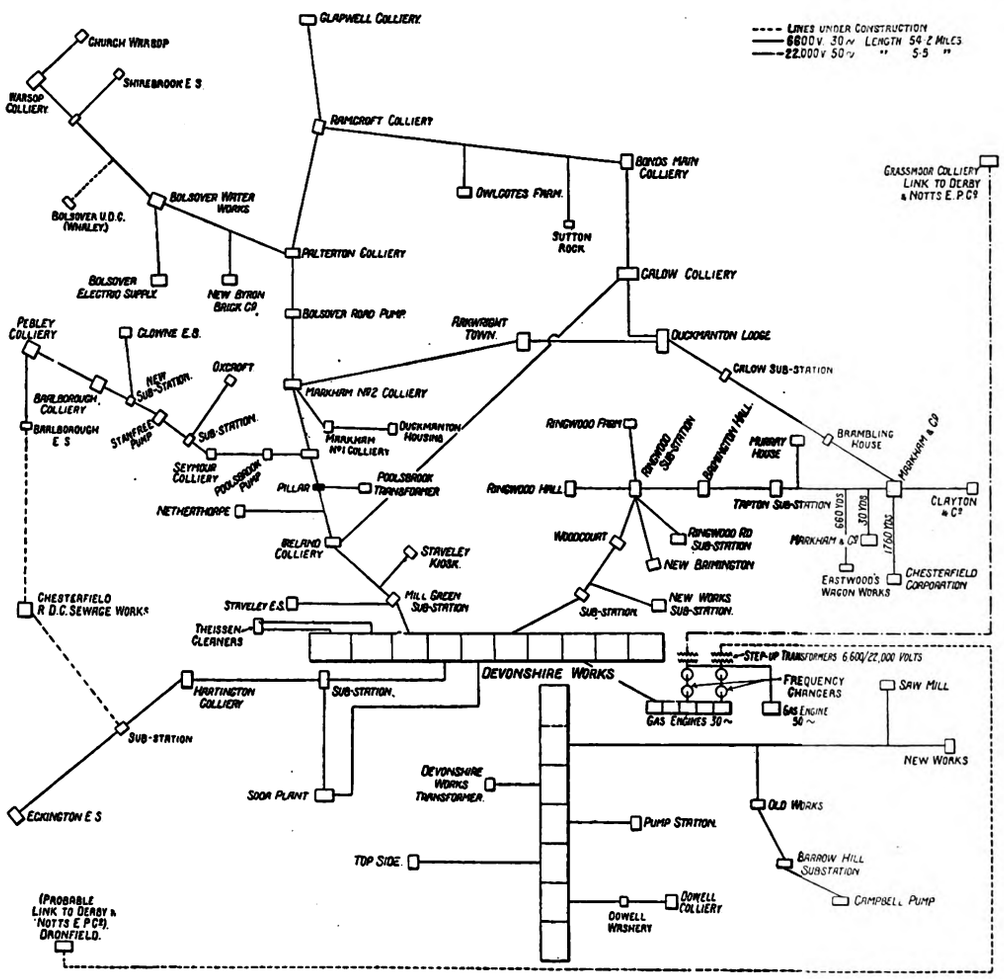

Fig. 1.—The Staveley Co.'s E.H.P. Network.

The activities of the company, of course, are centred round the production and treatment of coal, and cover a large area of some 60 sq. miles in which there are six collieries belonging to the company, three large works, Devonshire, old and new, devoted to obtaining by-products, three power stations, and 151 miles of h.p. and e.h.p. transmission lines serving a l.p. network to which about 7,000 consumers are connected.

Regarding the company first as a supply undertaking, it is in a particularly favourable position from two very important points of view: first, practically the whole of the power production is by the utilisation of waste heat from the coal-treatment part of the business; and, secondly, the undertaking can to a great extent control its own load factor by putting on load in its own works when convenient. Low-calorific gas of about 100 B.th.u. per cu. ft. at 68 deg. F. is used both for firing boilers for the production of steam for turbine plant and for driving gas engines, and the annual load factor is in the neighbourhood of 70 per cent. The total capacity of a.c. plant installed is 27,000 kW. Last year 70 million units was the output of the whole concern, of which about 25 per cent. was sold to outside consumers. The company supplies in bulk to the Derby and Notts. Power Co. A number of outside collieries is served by the Staveley concern, which also supplies several pumping stations in the district and a number of villages.

The cost of generating electricity is so low that the company is able to dispose of its output, with a reasonable profit, at an average figure of 0.55d. per unit, which, we believe, is the lowest figure of its kind for the whole country.

To deal first with the generating plant in use by the company, as already indicated the bulk of the electricity is produced at Devonshire works and from very-low-grade gas. The gas is obtained from blast furnaces, and before use under the boilers or in the gas engines it is treated in a cleaning plant consisting of three vertical water scrubbers, each 15 ft. in diameter and 72 ft. high, filled with wooden hurdles, and down which 5,000 gallons of water per minute is circulated. The water is pumped to the top of the towers by duplicate Worthington-Simpson pumps, each capable of dealing with 5,000 gal. of water per min., driven by 300-h.p. motors. The gas then passes through three Thiessen washers in parallel, fig. 2, each capable of dealing with 211,800 cu. ft. of gas per hour. These are mechanical centrifugal water washers. The water used in this plant, containing the solid matter washed from the gases, passes to a Dorr clarifying pond to separate the suspended solid matter, and is then pumped to an open spray cooling pond, where it is cooled and again collected and re-circulated to the scrubbers. Each washer is driven by a 500-h.p. A.C.E.C. slip-ring motor, 575 r.p.m. Three smaller Thiessen

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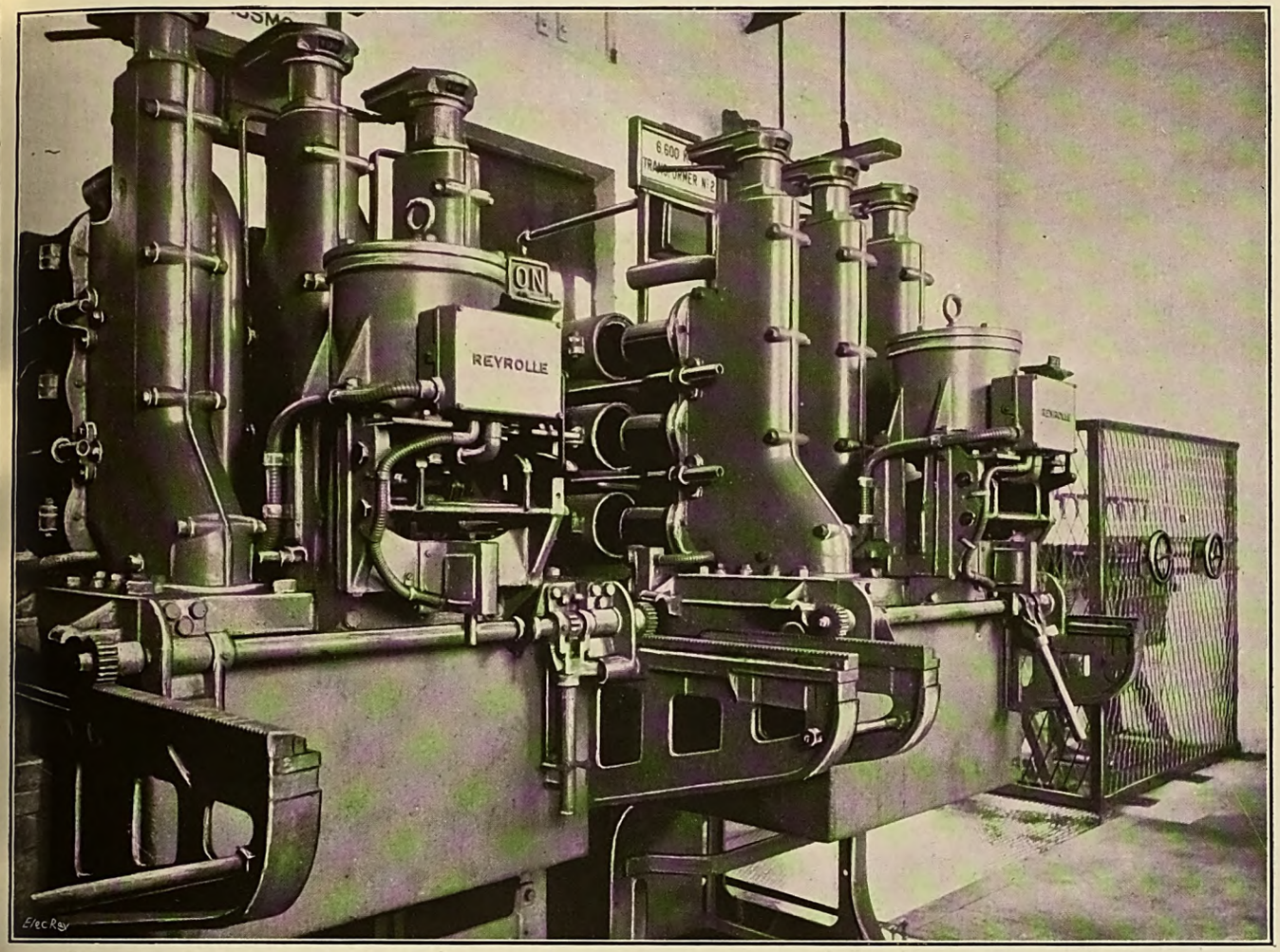

Fig. 9.—22,000-V Switchgear Controlling Transmission System.

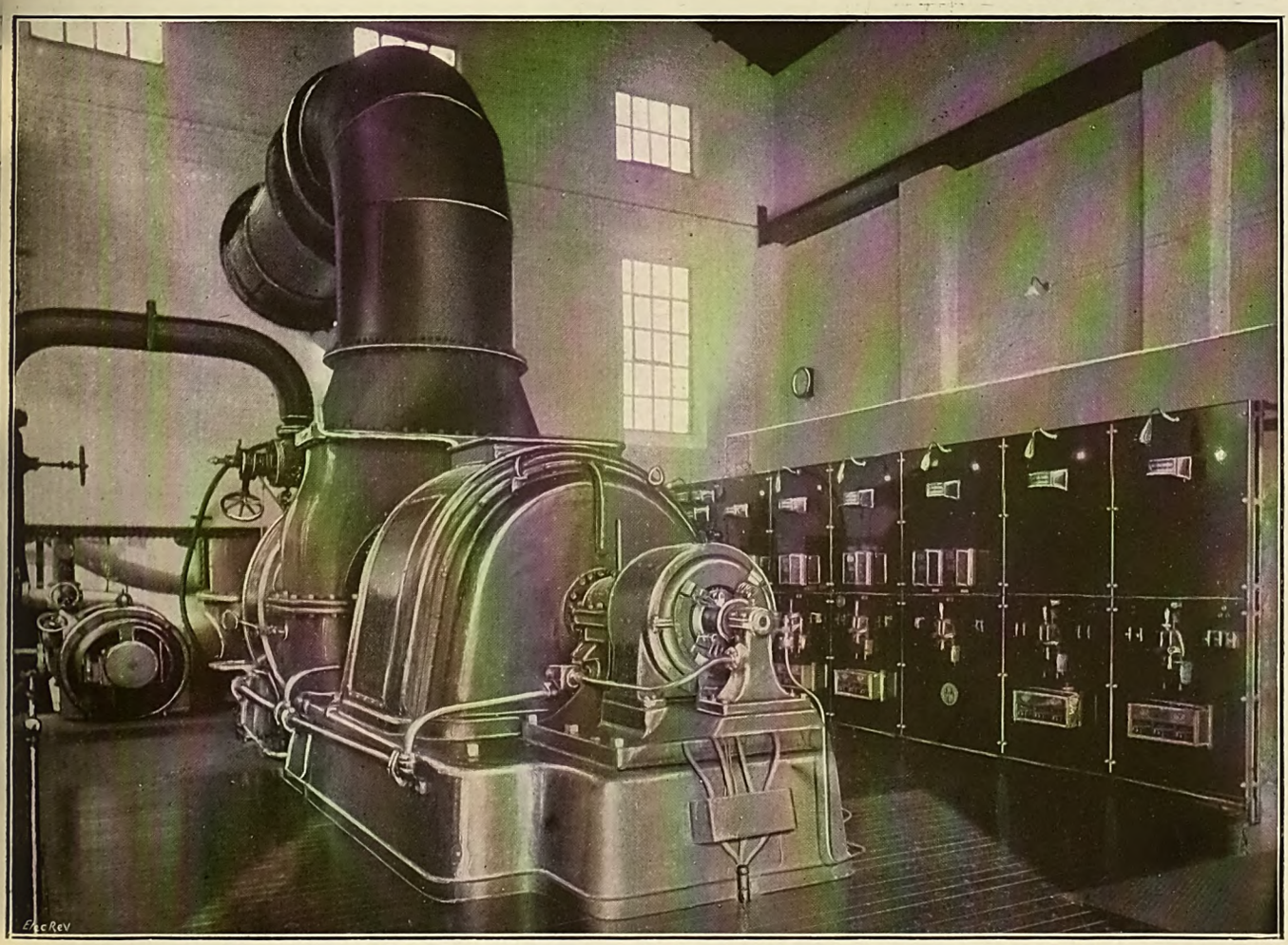

Fig. 10.—Interior of Markham Power House; 1,500-kW M.P. Turbo-alternator.

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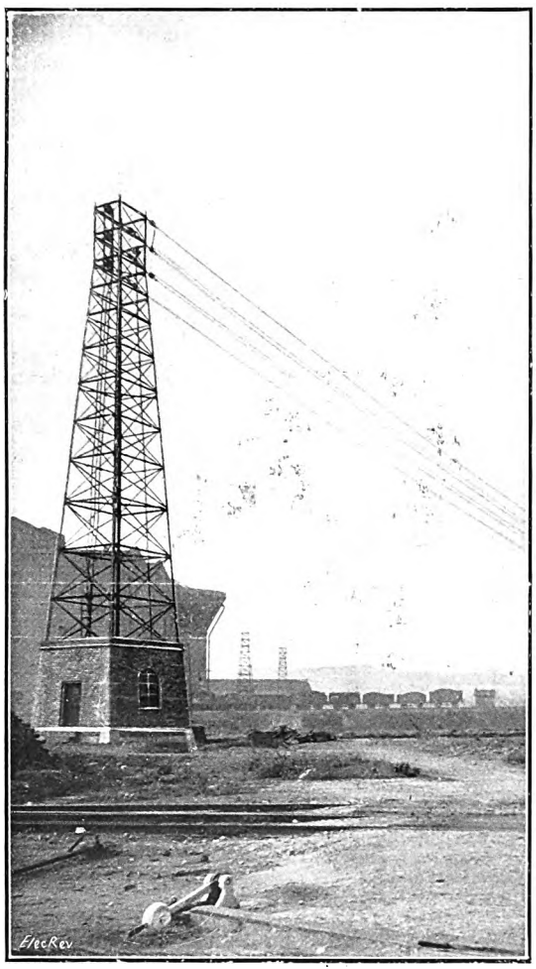

Fig. 11.—22,000-V and 6,600-V Line; Sub-station in Tower Base.

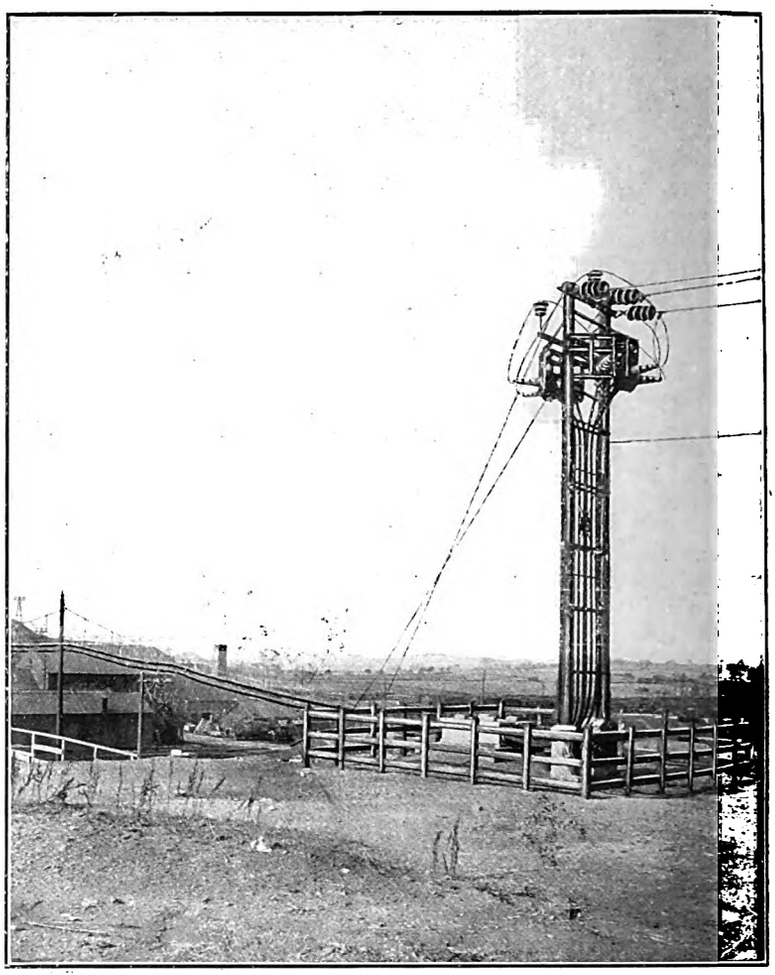

Fig. 12.—Terminal Pole at Grassmore; 3-core Cables Slung from Steel Poles.

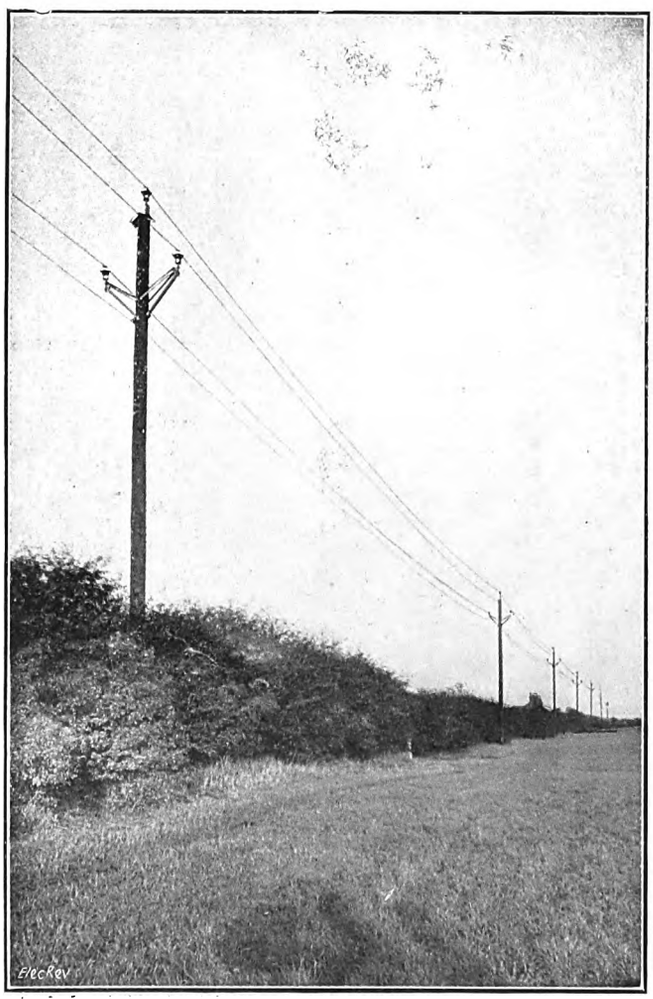

Fig. 13.—6,600-V Line; Bird-guard Brackets.

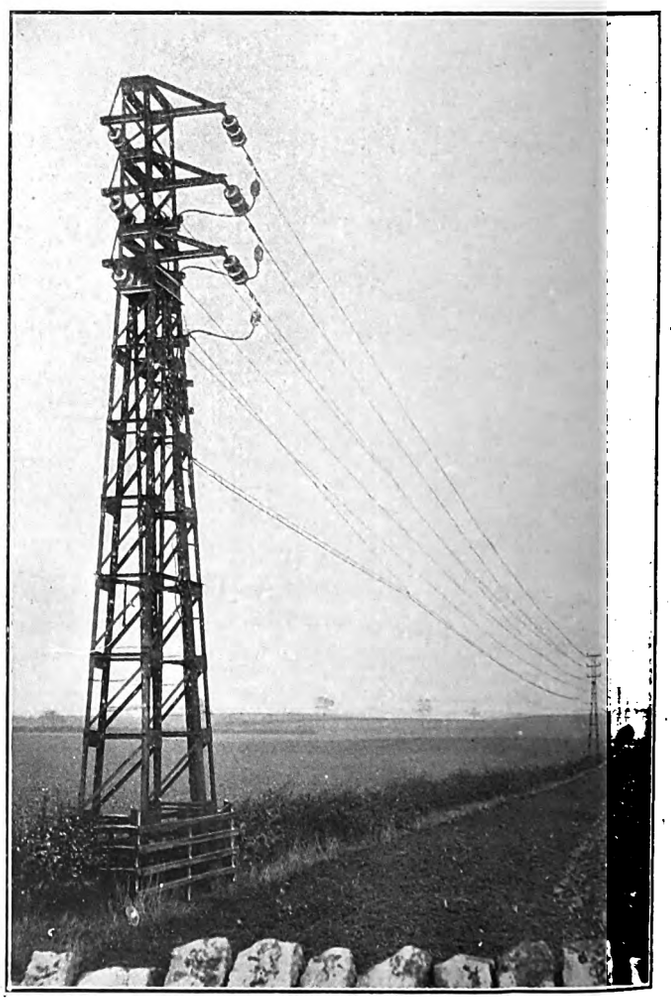

Fig. 14.—Six-wire Line on Lattice Towers.

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washers deal finally with the gas before it is used. The boiler plant consists of 20 Babcock & Wilcox water-tube boilers, with a total capacity of 415,000 lb. of steam per hour. The steam conditions are 160 lb. per sq. in. and 570 deg. F. Sixteen of these boilers are fired with gas from the blast furnaces, as already explained, and the remaining four are served with gas from coke ovens. Eight waste-heat boilers are equipped with stoker grates for coal firing in case of emergency, and oil-firing is also provided for on seven other boilers. The boilers are all installed out in the open, and their working is very satisfactory. Fig. 4 shows a portion of one battery of boilers.

The generating plant proper is installed in two separate buildings, one housing the steam-driven equipment and the other the gas-engine sets. In the steam section there are a 5,000-kVA and a 3,000-kVA mixed-pressure, Metropolitan-Vickers, turbo-alternators, fig. 3, and a 1,000-kVA exhaust-steam turbine set of similar make, generating at 3-phase, 6,600 V. Low-pressure steam for the m.p. and l.p. turbines is obtained mainly from the exhaust from five large Galloway vertical blowing engines installed in the steam power house; these are employed to serve the blast furnaces. There are also two d.c. Browett & Lindley reciprocating-engine sets, 1,000 kW and 500 kW, respectively, which act as stand-by to a 1,500-kW M.V. rotary convertor. The latter machine is of the double-commutator type, an essential arrangement to permit of a large output at such a low voltage, 250 V d.c. Double slip rings on the a.c. side are also provided, and the machine runs at 360 r.p.m. Reyrolle standard h.p. switchgear controls the alternators and various feeders. This, with a portion of the control board, is shown in fig. 5. For use in connection with the condensing plant for the turbines there are three cooling towers by the Premier Co. and three by the Davenport Co.; each set of three has a capacity of 200,000 gallons of water per hour.

In the gas-engine house there are three 7,150-h.p. 4-cylinder tandem-type gas-engines by the Société Anonyme John Cockerill driving 5,000-kW alternators of A.C.E.C. manufacture. These are believed to be the largest gas engines installed in this country. Two of the alternators are 30-cycle machines and run at 90 r.p.m., while the third one supplies at 50 cycles and runs at 94 r.p.m. The alternators are of the fly-wheel type and are excited by means of three 110-kW motor-generator sets, 220 V d.c. Fig. 7 is a view of one of the gas-engine sets, looking at the alternators through the avenue between the two sections of the tandem.

It is particularly interesting to note that even the exhaust from the gas engines is not wasted, but is discharged into three pairs of multi-tubular boilers of special design, fig. 8, which provide additional steam for general purposes throughout the works. Each pair of exhaust-heat boilers can raise 14,000 lb. of steam per hour at 150 lb./sq. in. and 115 deg. C. superheat.

In this section of the station there are two 2,500-kW rotary frequency changers, 50/30 cycles, 600 r.p.m., fig. 6; these are synchronous machines on both sides. Separate exciters are supplied for both sides of the changers, and for starting there is an induction-type pony motor equipped with a liquid rotor resistance. The main switchgear for the gas-engine section (M.V.), in addition to serving for the alternators, also controls the a.c. sides of frequency changers and some 6,600/22,000-V step-up transformers for the transmission system.

At the Markham power station there is a 1,500-kW mixed-pressure turbo-alternator of British Thomson-Houston manufacture, 1,800 r.p.m., 6,600 V, fig. 10. Low-pressure steam for this turbine is obtained from the exhausts from the winding engines and air compressors at the colliery, while h.p. steam is supplied from suitable boiler plant. A feature of this plant is that the turbine exhausts into a surface condenser in the open, *via* an overhead duct. The back pressure introduced by the duct is very small, while the condenser is in the coolest possible place and foundation work is eliminated to a very considerable extent. At the Warsop collieries there is a 1,200-kW A.E.G. mixed-pressure turbine set, 440 V, for the supply to the colliery.

With regard to the distribution side of the undertaking, fig. 1 will give some idea of the extent of the e.h.p. system. Most of the e.h.p. transmission is by overhead lines; the bulk is at 6,600 V and there is also some at 22,000 V. All the company's own collieries are supplied at the lower pressure, which also serves for some outside collieries and practically all the villages in the district, including some not owned by the company. The higher pressure is employed for transmission to the Grassmoor Colliery Co., and also to the Derbyshire & Notts. Power Co. Most of the 6,600-V overhead lines consist of 0.1 sq. in. bare copper wire carried on simple wood or " Kay "-type poles by Callender's Cable & Construction Co., Ltd. A typical example of a 6,600-V line is that shown in fig. 13. It is an ordinary 3-wire line on wood poles. A feature is the special design of the insulator brackets, which eliminates the necessity for the use of bird guards. It is interesting to note how the line is erected in the hedge bottom, the usual practice of the company wherever possible. A six-wire, 6,600-V line on lattice towers is shown in fig. 14; in this case a telephone cable is suspended from the towers. It has already been indicated that the supply for the 22,000-V system is stepped-up from the 6,600-V supply at Devonshire works. Fig. 9 shows the 22,000-V Reyrolle switchgear controlling this supply.

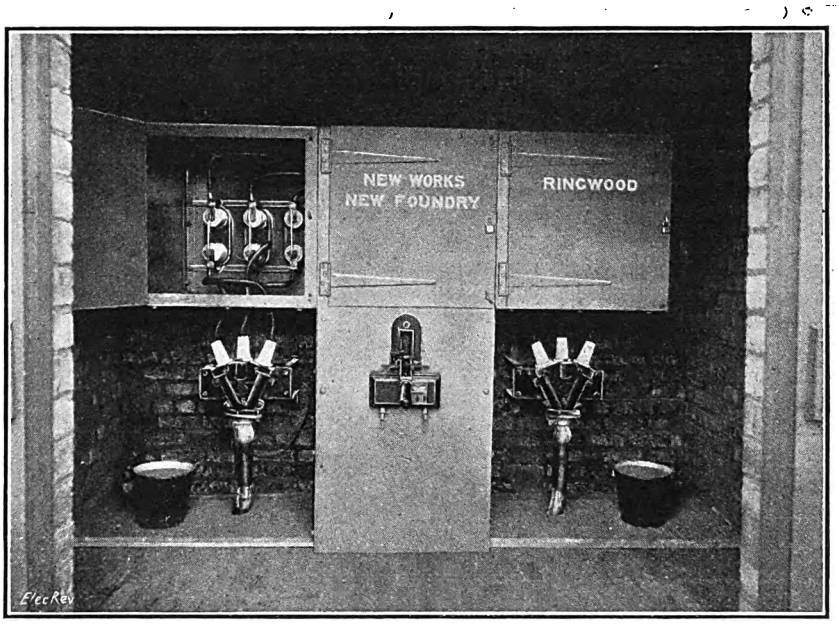

Fig. 15.—A Typical Transformer Sub-station.

Fig. 11 shows a lattice tower at the Devonshire works, carrying both 22,000-V and 6,600-V lines. The tower is 79 ft. high and a sub-station is built in its base. Fig. 12 shows the terminal pole of the 22,000-V single-circuit line at Grassmoor. Two sets of single-core cables lead to the overhead lines, cable-dividing boxes being arranged horizontally at the foot of the pole. The three-core cables to the trifurcating boxes are slung across the colliery yard from catenary wires on steel poles.

There are some 75 transformer sub-stations on the system, a typical example of which is shown in fig. 15. This illustration depicts the T cubicle; one end of the T box is open, and the isolators are visible.

In conclusion, we are indebted to the Staveley Coal and Iron Co., Ltd., for permission to visit its property and to take photographs, and to Mr. Scott Mackenzie, M.I.E.E., chief engineer to the Staveley Co., and Mr. Abell and other assistants for their help in gathering the above information.

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The Electrification of Russia.

An Ambitious Programme of Construction and Extension.

By LOUIS SEGAL, M.A., Ph.D.

THE work in connection with the electrification of Russia which is at present being carried out represents in the main the realisation of the programme elaborated by the State Electrification Commission in 1920. The programme provided for 39 regional power stations to be working in the year 1933. The progress of industry necessitated, however, the extension of the original programme to 48 stations with a capacity of 2,955,000 kW. In addition to the stations to be completed by that year, nine regional stations are to be under construction in 1933, which, together with the extension of existing stations, should increase the capacity of regional stations to 4,555,000 kW.

Regional power stations have begun to assume the leading *rôle* in supplying power in Russia and a great expansion in their construction is to take place during the current financial year. According to the programme, eight new regional stations which are at present under construction will start operating during the 1929-30 financial year (October 1st, 1929, to September 30th, 1930), as compared with ten stations which started operating in the preceding seven years. The new power stations to be started this year include the Shakhta with a capacity of 44,000 kW, which will supply power to the South-Eastern section of the Donetz basin and the industries of the Rostov region; and the Chuguyev station of similar capacity, which is to supply electrical energy to the town of Kharkov, the capital of the Ukraine. A 22,000-kW regional station is to be completed in Kiev; in Novorossisk one of 22,000 kW; in Krasnodar one of 11,000 kW; in Saratov one of 11,000 kW; in Cheliabinsk one of 49,000 kW; and in Ossinov, White Russia, one of 20,000 kW.

The total capacity of the new stations to start operating during the current year will be 223,000 kW. In addition to those, seven of the existing stations will be extended by 180,500 kW. The most important of these are the second installation at the Leningrad peat station, and the extension of the Shterovka and Nizhni-Novgorod regional stations. If we deduct the capacity of generators at the various stations which will be put out of commission during the year, the net increase in the capacity of the regional stations will amount to 388,500 kW. This represents an increase of 51 per cent. over the capacity of such stations on October 1st, 1929. At the end of the 1929-30 financial year it is estimated that a total of 27 regional power stations will be in operation with a capacity of 1,151,000 kW, as compared with 328,000 kW before the war. Beside the completion of eight regional stations, the programme for 1929-30 provides for the continuation of the work on a number of stations now under way, and the starting of eight new regional stations of the usual type and six special regional stations, which are to supply not only electric power but also heat.

In the Moscow area the construction will begin of the Bobrikov station, which is to use as fuel coal obtained from the Moscow region. Its initial capacity will be 150,000 kW and its eventual capacity 300,000 kW. In addition to the Bobrikov station, two others with a capacity of 150,000 kW will be constructed in Moscow. These are designed chiefly for supplying power for industrial purposes.

The construction of a motor car factory with an output capacity of 120,000 cars per annum in Nizhni-Novgorod necessitates an increase in the supply of electric power in that city. It has therefore been decided to build a new station on the Lukh River near the peat bogs of Ivanovo-Voznesensk. This station will be connected by h.p. transmission lines with the Nizhni-Novgorod and Ivanovo-Voznesensk electrical systems. It is aimed to increase by 1932-33 the output of the stations in those two regions to 1,500 million kW-hours. In that year the system is to be connected to that of Moscow, the output of which for the same year is estimated at 2,300 million kW-hours. It is anticipated that by that year the supply of electric power will fully satisfy the needs of the central industrial region which includes these three areas.

The electric power combine next in importance is the Zuev regional station, which is to be erected in the Donetz basin. The construction of this station will begin during the current financial year. It will use anthracite slack and will have an initial capacity of 88,000 kW.

The power station which has been constructed at the Don Soda Works is to be extended by 44,000 kW and is to become a regional station instead of being as at present a purely industrial one. A new station is also planned for the Lisichansk coal district in the Donetz basin. In the northern part of the Donetz basin, near Slaviansk, it is planned to construct a large industrial power station with a capacity of 75,000 kW to supply power to the chemical and other industries of the Donetz basin. The total power production in that area is estimated to reach a total of 2,000 million kW-hours by the financial year 1932-33.

In Transcaucasia, the recently completed hydro-electric station at Zemo-Avchalsk is to be connected with the Rion station now under construction. This combination is to have a capacity of 80,000 kW and will serve the Chiatura manganese mines as well as the Suramsk section of the Transcaucasian railway. The power stations in the Armenian Republic are also to be united in one system.

In the Leningrad area the programme provides for starting, in 1930, the construction of three heat and power stations with a total capacity of 65,000 kW. Preliminary work will also begin in connection with the construction of a new regional power station to use peat as fuel. At present work is proceeding in connection with the expansion of the second municipal station by 48,000 kW as well as the construction of the Svir hydro-electric station with a capacity of 180,000 kW.

Among other new stations the construction of which will begin during the current financial year the following should be mentioned: the Kazan central power station, capacity 15,000 kW; the Baksan (Mineralniye Vody) hydro-electric station, 25,000 kW; the Kuznetsk regional station, initial capacity 48,000 kW; the Ubinsk hydro-electric station in the Altai district of the Kazak Republic, to supply power to the non-ferrous metal works, 40,000 kW; and two hydro-electric stations near Tashkent in the Uzbekistan Republic. Of the last, the Chirchik station with an initial capacity of 40,000 kW will work in conjunction with a large factory engaged in the production of fertilisers for cotton growing, while the Kadirya station of 30,000-kW capacity will supply power to the city of Tashkent.

Among the central stations to be extended in the Urals during the 1929-30 financial year are the Kizelov and the Cheliabinsk stations, the capacity of each of which will be increased by 48,000 kW.

One of the principal problems in connection with the construction of power stations will this year be to reduce

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the duration of the period of construction. In particular the Svir hydro-electric station, near Leningrad, is scheduled to be completed in four years as against the original plan of five years. In addition to the construction of regional stations during the current financial year, there will also be constructed a number of factory, municipal, and rural stations as a result of which the capacity of power stations in Russia is to reach the total of three million kW by the end of the current financial year, which is about three times the 1913 figure.

The increase in electricity output shows an even greater progress than the construction of stations. While in 1913 output amounted to 1,945 million kWh, in 1926-27 it reached 4,100 million kWh, and in 1928-29 to 6,700 million kWh. The estimates for the current financial year are for an output of 9,000 million and for 1932-33 for 19,000 million kWh. The capital investment in electrical construction during the current financial year will amount to 700 million roubles, or approximately, £70,000,000.

Electricity for the Home.

Notes on the Tonbridge Undertaking; Selections from Manufacturers' recently introduced Products.

TONBRIDGE receives its electricity in bulk from its neighbour, Tunbridge Wells, its own generating plant being employed as stand-by and for use on peak loads during the winter months.

We were very interested to learn that meter rents had been abolished. The ordinary consumer never likes the idea of having to pay rental for a device which, he thinks, is put in solely for the suppliers' benefit. The rates of charge are quite reasonable for a country town, being 5½d. per kWh for lighting and 1½d. for heating, &c. In the outlying districts, some of them 5½ miles from

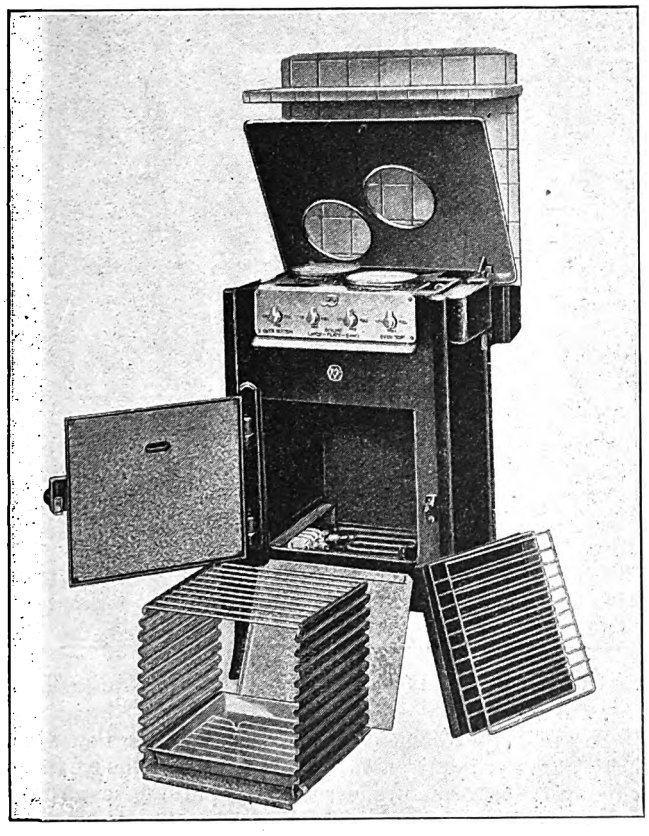

Fig. 1.—A " Cosmos " Cooker.

the works, higher charges are made. A two-part tariff is available, consisting of a fixed charge of 20 per cent. of the ratable value per annum, and a " unit " charge of 1d.

The assisted wiring scheme instituted by the Department is perhaps unusual. It applies only to lighting installations which are carried out by local electrical contractors to a schedule drawn up by the engineer, Mr. M. P. Plunkett. A prepayment meter is fitted set at 1s. per kWh, and 6½d. in the shilling represents repayment of the installation costs. No interest charge is made during the first year; 5 per cent. is charged on any outstanding balance at the end of that period.

Cookers are hired and hire-purchased, and while no particular make has been "standardised," there is something of a preference for the " Cosmos " cooker fitted with enclosed grill and boiling plates. The smaller model which is employed in the scheme is designed for fulfilling the requirements of three or four persons, and is constructed from selected sheet steel. The cooker has a stoved black-enamel finish, with mottled-grey enamel top plate and door panel, and round mouldings. The cooking space is 13 in. by 12 in. by 12 in., and the oven has a loading of 1,825 W; the grill loading is 700 W, and those of the two hot-plates 1,200 and 1,000 W, respectively. A view of the cooker demonstrating the ease with which it can be taken to pieces for cleaning appears in fig. 1. The cooker is supplied by METRO-VICK SUPPLIES.

A New Table Cooker.

We have received from the STOKES TABLE COOKER Co., 131, Woodhouse Lane, Leeds, a small electric cooking appliance invented by Lady Stokes, widow of the late Sir Wilfrid Stokes. It comprises an alu-

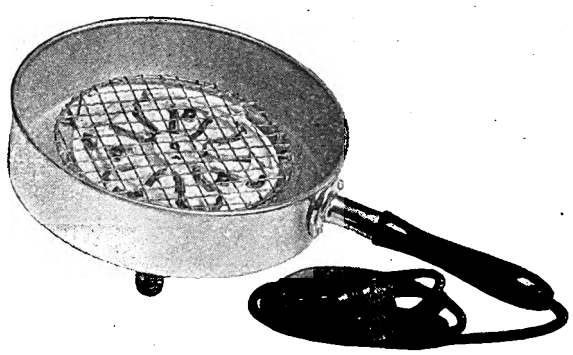

Fig. 2.—The " Stokes " Table Cooker.

minium pan, about 10 in. in diameter and 2½ in. deep, in the centre of which is fixed a 500-kW element. The latter is protected by a wire guard, and on the outside of the pan are heat-insulating feet. In use the cooker is put over a plate upon which the food to be cooked is placed. By this means grilling operations are carried out very rapidly and efficiently. The pan is fitted with a convenient wooden handle through which the connecting flex passes. The cooker, which is illustrated in fig. 2, has to be taken apart for cleaning, it being necessary to unfasten three nuts and unscrew the handle. The appliance can be used as a heater if desired.

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Electrical Engineers' Accounts.

An Outline of a Practical System of Book-keeping.

By S. HOWARD WITHEY, F.C.I., &c.

THE enormous growth in the demand for electrical energy, side by side with recent developments in engineering and the great expansion of the world's banking and commercial credit systems, calls for the adoption of accounting methods calculated to enable the electrical engineer—whether in business on his own account, a partner of a firm, or a director of a limited liability company—to prepare reliable trading accounts, profit and loss accounts, and balance sheets exhibiting a true and correct view of the state of the financial affairs of the business.

Commencing with the orders received, these should be recorded in a special book kept for the purpose. Whether they come to hand through the medium of the post; from agents, travellers, representatives, &c.; or over the telephone, the orders should be passed through the order book in a systematic and businesslike manner, and should not be allowed to accumulate in a drawer or on the office desk. Each entry should show the date on which the order was received; the name and address of the customer; a detailed specification of the power units, plant, equipment, or appliances required; and the current rate or price. In addition, columns should be provided in this book for the insertion of the date of supply or dispatch, and any remarks or observations of a special character associated with the transaction, while to facilitate future reference to details it is a good practice to show against each order the folio of the day book on which the sale transaction has been recorded.

When an order has been completed, the transaction will pass out of the category of orders and will become a sale or charge against the customer or buyer. If the particular goods or equipment, &c., are to be paid for on the spot, the amount of cash received will be recorded on the left-hand or debit side of the engineer's general cash book, with the date and the customer's name, from where it will be transferred or "posted" to the right-hand or credit side of a sales account opened in the impersonal ledger. But if, as is more likely, the customer has been allowed a period of credit, an entry will be made in the day book, or sales book, and the amount posted therefrom to the debit side of the customer's personal account opened in the sales ledger. At the end of each month, the total of the day book items should be transferred to the credit side of the sales account.

Amounts of cash received from credit customers or debtors will be recorded in the middle or "cash" column on the debit or receipts side of the cash book. These amounts should be posted to the credit side of the particular personal accounts, and if any discount has been allowed by the engineer in respect of payment within a recognised or stipulated period, the amount of such discount should be inserted in the inner or "Discounts" column on the debit side of the cash book—on the same line as the cash item to which it relates—and also posted to the credit side of the customer's account. It is permissible to show cash and discount in one amount, reading "By Cash and Discount," but, generally speaking, it will be found more convenient to show them separately.

Sometimes electrical appliances are unacceptable to customers for one reason or another, and they are returned. As such transactions are not likely to be numerous, they may be entered at the end of the engineer's day book, where a number of pages should be reserved for the purpose. The monthly totals of these items—including all allowances made to customers in lieu of actual returns—will be transferred to the debit side of the sales account, the individual items having been posted to the credit side of the respective personal accounts.

Debtors' accounts should not be permitted to run on month after month, but should be collected at the earliest possible moment. In this connection a good control can be effected by making out a list of sales ledger balances at the close of each month's transactions, and comparing the items with those relating to the previous month. To do this each personal account will have to be balanced, but before ruling off the accounts it will be advisable to prove the accuracy of the ledger as a whole, and this can be done by adding the monthly total of the day book, after deducting the returns and allowances, to the total balances outstanding at the commencement of the month, and deducting from this figure the total cash received from customers during the month and the discounts allowed, the result corresponding with the total of the ledger balances outstanding at the end of the month.

We come now to the purchasing side of the engineer's business. Upon the arrival of appliances, equipment, cables, wire, &c., entries should be made in an inwards book kept in the receiving department, and the details on the delivery notes carefully compared with the copies of the orders retained. As soon as the goods, &c., have been transferred to their allotted places, and the invoices have been received, the transactions should be recorded in the purchases book or bought day book, each entry giving the date of the invoice and the name of the suppliers. By using a purchases book which has been provided with a number of analytical money columns, the purchases can be classified under suitable headings by extending each amount into its respective column. At the close of each month's work, the total of the purchases book should be transferred to the debit side of the purchases account kept in the impersonal ledger, while each item representing the invoiced price will be posted to the credit side of supplier's personal account opened in the purchases or bought ledger. Goods returned by the engineer, also allowances made by suppliers in lieu thereof, may be recorded at the end of the purchases book, each amount corresponding with the credit note received, and posted to the debit side of the ledger account. Instead of transferring the monthly total of the returns outwards and allowances to the credit side of the purchases account, the amount may be deducted from the corresponding monthly total of the purchases before the latter is posted to the debit side.

Cash paid by the engineer in settlement or part settlement of creditors' accounts will be recorded on the credit or payments side of the general cash book from where the amounts will be debited to the personal accounts. To balance the purchases ledger independent of the other ledgers, the monthly total of the purchases (less returns, &c.) should be added to the total balances outstanding at the beginning of the month, and from this will be deducted the total of the cash payments made during the month and the discounts obtained by the engineer, giving the total sum owing to creditors as shown on the list of purchases ledger balances.

The best method of keeping and controlling the petty cash is that known as the "imprest" system. To commence operations by this method, a round sum—such as £5 or £10—should be withdrawn from the bank, this transaction being entered in the "bank" column on the credit side of the general cash book and also on the

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debit side of a petty cash book kept for the purpose of analysing expenditure which it is either impossible or undesirable to detail in the cash book proper. Each payment made out of petty cash should be recorded in a "total" column ruled on the credit or expenditure side of the petty cash book, and also extended into a suitably headed classification column. At the end of the month another cheque should be drawn, this time for an amount exactly equal to the total petty expenditure, this amount being also posted from the payments side of the general cash book to the debit side of the petty cash book, thereby showing the original round sum still in hand, or "imprest." Instead of transferring the monthly totals of the expenditure to the debit side of a sundry expenses account, it is better to post the total of each classification column to the debit side of a separate nominal or expenses account bearing the same name.

Management and working expenses which are paid by cheque will be shown in the "bank" column on the credit side of the general cash book, and should be posted individually to their respective accounts kept in the nominal or expenses ledger. Expenditure of a capital nature such as that incurred in the acquisition of assets will have to be debited to suitable accounts opened in the engineer's private ledger, this book being provided with a lock and key to prevent any unauthorised person having access to the accounts.

At the termination of the engineer's financial year, or at any other stock-taking date, the set of books should be balanced and the clerical accuracy of the book-keeping work verified by drawing up a trial balance consisting of all the debit and credit balances. As the essential principle of modern double-entry is that for every entry made on the debit side of one book or account there is a corresponding entry on the credit side of another book or account, and *vice versa*, it follows that, providing no errors have been made in any of the postings or additions during the accounting period under review, the total of all the debit items in the set of books will agree with the total of the credit items. In other words, the total of the debit balances must correspond with that of the credit balances as enumerated on the trial balance or summary.

In addition to proving the accuracy of the book-keeping, the figures on the trial balance can be very conveniently incorporated to constitute a trading account, a profit and loss account, and a balance sheet. The purpose of the trading account is to show the amount of gross profit made during the period, and should be drawn up to show, on the debit side, the value of the engineer's opening stock and the net purchases during the period, and on the credit side the net total of the sales and the value of the closing stock. The amount by which the credit total then exceeds the debit total will represent the gross profit, and this should be transferred to the credit side of a profit and loss account, the purpose of which is to show the amount of net profit realised, or the extent of the net loss sustained.

Grouped under suitable headings on the debit side of the profit and loss account will be the various expenses incurred and charges borne during the period. Before the result can be ascertained, it will be necessary to write off adequate depreciation in the value of the wasting assets employed, including boilers, turbines, dynamos, motors, machines, tools, &c. This may be done by charging against the periodical profits a proportion of the first or original cost of the assets, or by subjecting the assets to a new valuation by an acknowledged expert. In the case of the electrical engineer in business on his own account, the credit balance of the profit and loss account—representing the net profit made during the period—may be either added to the balance of his capital account and the amount retained in the business as additional working capital, or credited to his current account to be withdrawn for private purposes as and when required. In the case of a partnership, however, the amount of net profit will have to be shared between the partners in accordance with the deeds or other agreements, each partner's account being credited with the proper proportion, while if the business has been converted into a limited liability company, the trading profit must be kept distinct from the share capital by transferring the balance of the profit and loss account to the credit side of an appropriation account against which will be debited the dividends paid out to the shareholders, the sum transferred to reserve, &c., any balance then remaining being carried forward to the next financial period.

When the figures incorporated in the trading account and the profit and loss account have been approved and passed the remaining items enumerated on the trial balance will be summarised in the form of a balance sheet, the credit balances or liabilities being shown under their respective headings on the left-hand side, and the different assets on the right-hand side. As a rule the assets of a limited company are set down in the order of their permanence, but in other cases it is better to show them in the order of their convertibility, *i.e.*, according to the readiness with which they could be converted into actual cash, if necessary.

The products of the engineer engaged in the manufacture of electrical apparatus are usually of two kinds, *viz.*, products of standard design, and these of special design. Materials used in the assembly, consisting of manufactured parts issued on requisition, may be priced out at standard prices for costing purposes. When an order has been checked, an assembly order should be made out, together with a parts list for obtaining from the assembly department all the necessary parts. By keeping a cost ledger containing accounts of the raw materials, work in process, finished parts, wages, and overhead expenses, the figures may be readily reconciled with those recorded in the financial books.

Reviews.

The A.B.C. of Television, or Seeing by Radio. By R. F. YATES, M.I.R.E. Pp. viii+210; figs. 78. London: Chapman & Hall, Ltd. Price 10s. 6d. net.

This book represents a praiseworthy attempt to present in a convenient form both a simplified technical outline of the progress achieved in television to a recent date, and also information in fair detail that may serve an experienced amateur in assembling an experimental television receiver with at least fair success, and having regard to such objectives, the book can rightly claim a fair measure of success.

Some early developments are mentioned (Chapter I), the limiting restrictions in the present stage of development admitted, and a slightly interesting prophecy follows.

Fundamental principles of television systems are outlined (Chapter II) together with working principles of transmission and reception, including scanning disks and the scanning beam, followed by a brief description of the use of photo-electric cells and in more detail the simple neon lamp with its limitations, the more promising cathode ray, with its increased sensitivity, and then the reader is turned away to matters of speculative utility, namely, the recording of picture signals on wax records and the reproduction of pictures from them.

Photo-telegraphy is described in considerable detail (Chapter III), including transmission both by wire and radio, the interesting Kerr cell light control, vibrating mirrors and their concomitant inertia, various transmission systems including the Cooley with its corona discharge, the simpler "start-stop," the Bell and the "dot and dash"; and then (Chapter IV) to the photo-electric cell is reverted to, and a clear and concise description of its performance with curves and working conditions is given, as well as much useful data, even to their construction by the (intrepid) amateur.

The important subject of l.f. amplification is carefully discussed (Chapter V) together with the serious effects of vibration and interaction and their elimination; followed by extensive extracts from a technical paper dealing with research on the characteristics of l.f. amplification as applied to television, which shows the importance of removing or balancing the d.c. component, and finally (p. 132) a suitable l.f. amplifier circuit is given.

The neon lamp is then described (Chapter VI), with details of its application and general methods of connection in the anode circuit, and after this is recounted (Chapter VII) the earlier use of selenium, wih detailed instructions for the construction of selenium cells.

The problem of scanning is next dealt with (Chapter VIII) and clear instructions are given for forming a simple yet effective scanning disk for amateur use, also an outline of more accurate (and elaborate) means that have been used, continuing by reverting to the simpler disk with details of

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a drilling jig; while Chapter IX discusses in detail the difficulties of synchronisation with particulars of some of the methods that have been employed, but without mentioning the simple stroboscopic method.

The final two chapters give fairly detailed instructions for setting up both a transmitter and receiver for home use.

The book as a whole deals with an interesting subject in a useful and simple, although incomplete, manner; while the illustrations are both numerous and good, the diagrams clear, as are the sketches, but some of the latter are poor in their order of arrangement. There is but little space given to the use of the cathode ray, which several authorities familiar with the problem consider has alone the required rapidity of functioning, and with which Dr. Dauvillier has done much work and obtained patents for the polychrome process, and by both infra-red and ultra-violet rays. The book under review contains a few errors of omission, such as on page 86 and in the first sentence of page 140, and several American expressions such as on pages 22, 36, 46 and elsewhere, the book furnishes a lucid description of simple television apparatus and, in view of the widening interest and increasing broadcast facilities, both in this country and abroad, is well worth a place on the shelf of the experimentally inclined radio amateur and anyone interested in this subject.

First Year Electrical Engineering. By D. J. BOLTON, M.Sc., M.I.E.E. 7½ in.×5 in.×¾ in. Pp. xi+260; figs. 118. London: Edward Arnold & Co. Price 5s. net.

The days have passed when the first year student in an electrical engineering college had to spend much of his time studying what was termed "magnetism and electricity," or, perhaps, in an endeavour on the part of those responsible for the curriculum to assess the relative importance of the two parts of the subject of "electricity and magnetism," but the difference applied only to the title and what was taught represented the pure science which underlay the more practical "electrotechnics" which the student would reach in his second year. To-day, it is recognised that, while a knowledge of the theories of electric and magnetic science is essential to an intelligent appreciation of the elementary principles of electrical engineering, there are many parts of the science as previously taught which are of but little value to the practical student of electrical engineering as distinguished from the student who hopes to specialise in design or to take up research, and as a consequence the curriculum of the first year student has taken a far more practical form, and much of the pure theory has been eliminated. As an illustration of this modern tendency, it is only necessary to mention the extent to which electrostatics, the rubbing of glass rods with flannel, experiments with gold leaf electroscopes, and so on formed the subject of study of a previous generation of electrical engineering students. Comparing this with the attention paid to these parts of electrical science to-day, the modern tendency will be at once understood.

In the book which lies before us, the author has endeavoured to cover a course suitable for first year students in electrical engineering at a day technical school, and while he has, to a certain extent, broken away from the traditions of the past he still gives, we venture to assert, too much prominence to the theoretical side of his subject, while neglecting what should be regarded as the essential parts of a first year student's knowledge of practical electrical engineering. Criticism might also be raised against the arrangement of the contents of the book, particularly if the conscientious student is persuaded by his lecturer to work systematically through it chapter by chapter. We rejoice to notice that the author, having divided his subject matter into five sections, starts off with the study of the electric current, and we are pleased to find that he uses throughout the symbols given in the British Engineering Standards Association glossary. This part of the book is very well written and great care has obviously been exercised in the choice of examples on such problems as work, energy, and power, these being of a thoroughly practical nature. But it is difficult to justify the placing of the section of electro-chemistry second, with its lengthy description of the various types of primary cell, although electrolysis and secondary cells which are necessarily included in this section are of practical importance. The third section deals ith magnetism and comprises three chapters, *viz.*, one on natural magnets, one on electro-magnets, and one on motors and generators. Unfortunately, despite the importance of these machines to the electrical engineer they do not received any further treatment, and the student at the end of his first year, if he depends on this book alone, would know practically nothing about dynamos, alternators, and d.c. and a.c. motors. We certainly think that to justify its title this part of the subject demands considerable amplification, even if other parts have to be drastically cut. What tends to emphasise this failure to deal adequately with so important a subject is that, after a short section on electrostatics, the author concludes with a section entitled "Applications," in which, among other things, instruments, illumination, and telephony are dealt with, but in which the vast subject of electric power, either production or utilisation, is not mentioned.

We willingly pay a tribute to the able manner in which the author has dealt with the subjects he has chosen to include in his book, to the care which he has exercised in the choice of his numerical exercises, and to the commendably low price at which he offers it the public, but we feel that, for a book claiming to meet the requirements of even first year students of electrical engineering, its failure to deal in an elementary manner with so important a subject as electric power production, distribution, and utilisation detracts considerably from its value. Even from the historical point of view it fails in this respect, for, whereas a brief but interesting history of current electricity, magnetism, and so on is included at the beginning of the respective sections, no mention is made of the historical discoveries, which led to the invention of the dynamo and the motor. The book posesses distinct merits from the students' point of view, but it hardly justifies its title as an elementary text book of electrical engineering.

High-Voltage Cables: Theory and Practice of their Design and Operation. By P. DUNSHEATH, O.B.E., M.A. (Cantab.); B.Sc. (Eng., Lond.), M.I.E.E. Pp. xii+161; figs. 117. London: Sir Isaac Pitman & Sons, Ltd. Price 10s. 6d. net.

This book is based on a course of lectures delivered by Mr. Dunsheath at University College, London, the object of which was "to summarise the accumulated mass of information and make it conveniently available for the many engineers and students who cannot hope to see all the original published literature" on high voltage cable technique.

After a short review of the economic and technical considerations which have led to the demand for high-voltage cables, the author deals briefly, but lucidly, with fundamental principles of dielectrics, describes and analyses the V curve, and explains the methods used in cable factories for the measurement of dielectric loss.

The theory of breakdown is dealt with under the headings: (1) Breakdown on stress; (2) Pyro-electric effects; (3) Mechanical movement; (4) Structural imperfections. Each theory in turn is described as fully as is practicable in such a short space.

In the next chapter the design and manufacture of high-voltage cables of the three-core belted, screened, and S.L. types are described, and their relative conditions discussed.

Single-core cables are the subject of the next chapter, and sheath effects and the measurement of sheath losses are considered.

The heating of cables, its causes, measurement, and effect are dealt with under the headings: (1) I^2R loss in the conductor; (2) Dielectric loss; (3) Sheath and armouring losses; and this chapter terminates with a section on quality, assessment, and stability.

A well-illustrated chapter is devoted to jointing, and last, but certainly not least, there are descriptions of various special designs of cable, including the 132-kV single-core, oil-filled cables installed in New York and Chicago, and a 70-kV 3-core cable for an Italian scheme which was described in the ELECTRICAL REVIEW, Vol. 101, page 622 (1927).

The principal difficulty which faces the author of such a book as this (we quote from the preface) is that the subject "is in such a state of flux, and the development of both theoretical conceptions and practical designs so rapid, that the attainment of finality in the printed record is not easy." Mr. Dunsheath has met this difficulty, as he set out to do, with the finger "pointed in the direction of future development in those cases where the probability is already evident." For example, he points out (page 51) that the explanation of the V curve of dielectric losses has by no means arrived at a final state. On page 68 he says that the mechanism of breakdown in a cable dielectric is complicated and little understood, and that theories are, generally speaking, tentative and incomplete. Then on pages 108 and 109, though the author's opinion appears to be that belted cable should be used up to a pressure of 22,000 volts, metallised core, three-core type, from 22,000 to 33,000 volts, and single core cables above the latter voltage, he states that there are a few engineers who still advocate making the belted type up to 33,000 volts, and the reader is left wondering whether the metallised core cable is only a passing phase, and whether in a few years' time the type will disappear.

It is a disappointment to the present writer that the section headed "Quality Assessment and Stability" is confined to two short pages. Surely this is a subject which is most important to the "many engineers" for whom this book is specifically written. The user of cables is generally quite content to leave design and manufacture entirely in the hands of the cable maker, but he does want some proof that the finished article is going to stand up in service. It is certainly disconcerting to learn that it is a risky proceeding to lay out, and pick up again, a length of high-voltage cable for testing purposes within the precincts and under the supervision of experts of a cable factory.

To one who only occasionally has to deal with cable problems, it is always a puzzle why cable manufacturers cannot adopt some international standard of nomenclature. Chapter 10 is a fine example of the present-day confusion. It is very hard for one used to English units to visualise 95 sq. mm. cable with a thickness of insulation of 0.4 in. and compare it with 500,000 cir. mils with insulation thickness of .94 in.

The book measures .24 yd. by 14.5 cm., and has an equivalent cross sectional area (vertically) of 4.32 sq. in. and (horizontally) 3,650,000 cm. It is particularly well illustrated, and the references which are given to publications on the subject dealt with in each chapter will help readers to pursue their studies further.

Mr. Dunsheath has, in our opinion, most successfully achieved his object. We have read the book with the greatest interest and instruction, and can thoroughly recommend it.

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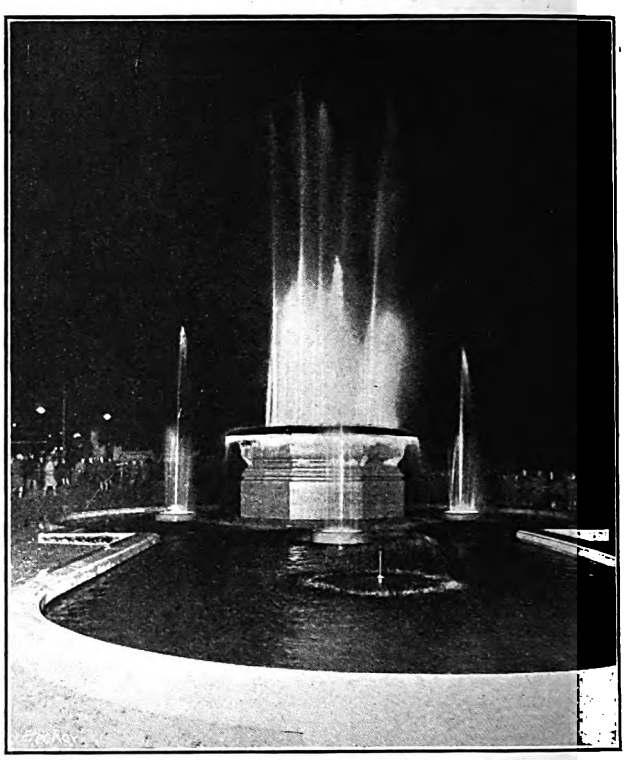
An Illuminated Fountain at Bournemouth.

An Installation Providing Wonderful Colour Effects and Possessing Several Novel Features.

WE reproduce herewith a photograph sent us by W. T. Henley's Telegraph Works Co., Ltd., of the illuminated fountain in the grounds of the New Pavilion, Bournemouth. The design was produced by the British Thomson-Houston Co., Ltd., whose coloured floodlighting equipment is employed in the illumination of the structure and the fountain was supplied through the Edison Swan Electric Co., Ltd. The fountain stands in the centre of an irregularly-shaped pool, which is approximately 150 ft. long and 50 ft. wide. The centre basin is nearly 9 ft. high and 14 ft. across. There are remote push button controls in the Pavilion, in addition to full controls in a chamber in the centre of the structure and immediately under the shallow centre basin. Housed in this chamber are a 7½-h.p. 3-phase motor to operate the four smaller fountains and fill the centre basin, and a 10-h.p. 3-phase motor, which operates the jets in the centre main basin. Turbo pumps of Mather & Platt manufacture are connected to these motors. A special switchboard was built up on the site by Messrs. Aish & Co., Bournemouth, who carried out the installation. The switchgear is by the Midland Electric Manufacturing Co., Ltd., and the controls are B.T.H. and Igranic. In the centre of the chamber are five waterways, each of which is controlled by a magnetic valve, the valves being operated by an automatic flasher of special design, which governs the water effects and colourings. The heating of the chamber is automatically regulated by a thermostatic switch controlling a "Morganite" heater, and an electric fan is also installed. The illumination is so arranged that there are 72 changes of colour and various colour combinations every ten minutes. Installed in the centre of the structure are thirty 1,000-W projector lamps with five different coloured glass screens, and each of the four smaller fountains in the pool is equipped with a 1,000-W projector lamp and a coloured glass screen as a centre. The bronze rim around the large centre basin contains 120 60-W green glass lamps. The colours of the four small fountains in the pool are constant—red, blue, amber, and green. With the exception of the natural green lights under the broaze rim of the centre basin, which are projected downwards to the water in the pool, all the lights are projected upwards into the sprays. All the projectors are of the submersible type, and the lamps are water cooled. Two thousand yards of "Henley" c.t.s. 600-megohm C.M.A. grade cable was used for the wiring of the fountain. The main cables are also Henley's. All the main cables are run in an earthenware duct from a remote control board in the Pavilion, the duct running under the water to the chamber underneath the centre fountain. The main cables are taken to the main switch in the chamber, thence through distributor boards to



Effective Fountain Illumination at Bournemouth.

five specially-designed 6-way, watertight distributing glands in the ceiling of the chambers. From each gland cab tire tails are taken off to the multi-coloured lamps.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

Our Issues of December 20th and 27th.

Owing to the Christmas holidays it is necessary that all editorial matter for the ELECTRICAL REVIEW of December 20th and 27th shall be received by us some time earlier than usual.

"Electrical Review" Index.

The Index to Vol. CV (for the half year ending December 31st, 1929) will be published shortly, and we shall be glad to receive the names and addresses of those who require it (free of charge) for binding purposes or wish to retain it for reference. Application should be made as early as possible to the Publisher, 4, Ludgate Hill, E.C.

The E.T.B.I. Competition.

Capt. J. T. Keeping, the secretary of the Electrical Trades Benevolent Institution, has sent us a list of prizes and prize-winners in the "cable" competition recently organised by the Institution. The first ten prizes and their winners were as follows:—

Portable "Screen-grid 4" wireless set (presented by the General Electric Co., Ltd.), won by Mr. G. J. Steer, Luton, Beds.; a 3-stage wireless set (British Thomson-Houston Co. Ltd.), Mrs. N. Baker, Stockwell, S.W.; a "Cosyglo" electric fire (Siemens Electric Lamps & Supplies Ltd.), Mr. N. W. Riley, Manchester; a two-stage wireless set (British Thomson-Houston Co., Ltd.), Miss M. Savage, Wallington; electric fire (Arora Co.), Miss Jones, Harrow; camera (Houghton-Butcher (Gt. Britain), Ltd.), Mr. D. K. B. McGregor, Wembley; floor standard and shade (Messrs. Young and Wildsmith), Miss H. M. David, Cardiff; electric radiator (Edison Swan Electric Co., Ltd.), Mr. W. H. Tranmer, Reading; "Bandy" 10-inch fan (Messrs. Berkeley & Young, Ltd.), Mr. P. M. Plucknett, Wood Vale, N.; loud speaker (Mullard Wireless Service Co., Ltd.), Mr. H. J. Yarwood, Moseley, Birmingham. The pewter rose bowl presented by Mr. Justus Eck, for selling the winning ticket was won by Mr. L. E. F. Baenziger, St. Albans. There were many other prizes presented by electrical and other companies.

The Burnley Transport Post.

Regarding the suggested advertisement for a new transport manager to Burnley Corporation, Coun. Broadley, at a Town Council meeting on December 5th, said that no man would come to Burnley to reorganise the system at a salary of £550 rising to £600. He believed they had men in Burnley capable of filling the post. Ald. Buchanan said they must have a manager to control traffic. It would be a mistake to overload one official with too many duties. Mr. Hartley suggested a manager for trams and another for 'buses. Mr. T. P. Taylor mentioned that their 'bus traffic had been losing

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£5,000 a year. He believed they must have one manager of both trams and omnibuses, for the latter would some day supplant the tramcars. The Committee's minutes were approved.

Registered Electrical Contractors.

Applications from the following for registration were accepted by the Executive Committee of the National Register of Electrical Installation Contractors at its last meeting:—

Firth, J., Manchester.
Gaskell & Garraway, Ltd., Taunton.
Wilkinson's Wireless & Electrical Co., Lytham.
Penrose & Son, Plymouth.
Swift, T. W., Selby, Yorks.
Maclean, K., Chorlton-cum-Hardy, Manchester.
Burton, W. H., Chesterfield.
King, H. H., & Co., Longsight, Manchester.
Podmore, W. H., Wolverhampton.
Hammond, C. W., Plymouth.
Lowrey, A. S., Newcastle-on-Tyne.
Fear, E. J., Cheltenham.
Hill, W. F., Dalston, E.8.
Wyeside Welding & Battery Service Co., Hereford.
Thomas Lewis & Sons, Ltd., Aberystwyth.
Darby, G. A., Birmingham.
Watson & Sons, Oldbury.

At the same meeting one application was withdrawn, and seven were declined.

An Architectural Association Bureau.

In August, 1928, the Architectural Association opened a Building Materials Bureau, primarily with a view to providing a series of actual samples which could be used to illustrate lectures to students of architecture at the Association's schools. The use of the Bureau has since been extended to members of the Association to enable them to trace any particular building material they may require, and to keep in touch with new developments. The latest addition to the Bureau is an electrical section where various types of switches, lamps, wiring systems, &c., are displayed. In addition, there is a very complete reference library of manufacturers' products in every sphere, and advice is given to architects as to the type of material, &c., required for a particular job.

New G.E.C. Works in Australia.

The *Sydney Morning Herald*, dated October 26th, reported a speech by Sir William Noble, a director of the General Electric Co., Ltd., regarding the establishment of a telephone apparatus factory in Sydney. He said that he was following the advice of Sir Hugo Hirst in going to Australia to study conditions at first hand. In establishing a factory the company had to pay due regard to the limitations of the Australian market. It would not pay them to turn out the large equipment now manufactured in England by mass-production methods. Their proposal was to manufacture the smaller types of telephone and electrical plant until the further development of the enterprise was justified by the corresponding development of the Commonwealth. Sir William announced his intention of visiting New Zealand.

German Cable Combine.

The registration is reported to have taken place in Berlin of the "Indeska," a community of interests of the "special" cable works. The object is to promote the common interests of the members, and the establishment or acquisition of wire and cable works, &c., particularly the foundation of works abroad. The nominal share capital is 500,000 marks.

The American Position.

Dealing with current events in the United States, the New York correspondent of *The Times* says that in spite of pledges of large industries to expand operations, unemployment is steadily increasing. The motor-car industry last month reduced production to about 40 per cent. of the average of the previous 10 months, but work has begun on new models, and December may show a small increase over November. Some manufacturers are frankly admitting that saturation point has been reached in the automobile industry, which this year increased production by 25 per cent., as against a five-year average annual increase of only 2 per cent. The Ford Company has increased uneasiness in the industry by its announcement that it is expecting the biggest production in its history, and that in a few days it will re-employ all men temporarily laid off at its plant. This is taken in some quarters as substantiating the report, often circulated, that the Ford Company is about to put out a six-cylinder car, and so compete even more intensively with the Chevrolet and other low-priced cars.

The Australian Customs Tariff.

The *Board of Trade Journal* for December 5th contains a statement of the principal alterations in Australian import duties which came into operation on November 22nd. Radio apparatus, which was formerly subject to a duty of 35 per cent. *ad valorem* under the British preferential tariff and 55 per cent. under the general tariff, is now subject to a series of specific duties. The duty on sets, excluding accessories, is 20s. per valve-holder under the British preferential tariff and 30s. under the general tariff; on complete sets the old *ad valorem* duty remains in force. The new duties on ironclad air-break switches and switch-fuses, up to 100A are 3s. each, or 45 per cent. *ad valorem*, under the British preferential tariff, and 5s., or 60 per cent., under the general tariff.

New Swiss Company.

The Volta Gesellschaft für Elektrische und Industrielle Unternehmungen is the name of a concern which has recently been formed in Zurich (28a, Bahnhofstrasse) to finance electrical undertakings.

Uruguayan Duties on Radio Apparatus.

A Bill has been prepared for submission to the Uruguayan Congress for additional import duties on radio apparatus. The proposals include an additional 30 per cent. upon the official valuations applying to radio-telephonic apparatus and radio receiving-sets, excluding valves and loud-speakers; and an additional 20 per cent. upon the official valuations applying to valves. At present the import duty on radio apparatus is 31 per cent., plus a surtax of 14 per cent.—*Reuter's Trade Service* (Montevideo).

Bankruptcy Proceedings.

C. W. SANDS, High Street, Kings Langley, Herts, electrical and wireless contractor.—The public examinatiton of this debtor was held on November 27th, at the Court House, St. Albans, when a statement of affairs was filed showing ranking liabilities of £369, against assets estimated to produce £105, leaving a deficiency of £264. The debtor attributed his failure to lack of capital, keen competition, law costs of suing creditors, and household and personal expenses in excess of profits. In May, 1926, while owing £95 for law costs, he purchased a retail wireless business for £50. In 1927 he added to his business that of an electrician. He was fairly successful, and the business provided him with a living until about eighteen months ago, but since then, owing to local competition, he had experienced difficulty in meeting accounts as they became due. He had been drawing about £3 a week out of the business. He stated that he became aware of his position in October, 1928. The hearing was adjourned.

E. E. PEACE, rear of 230, High Street, Erdington, Birmingham, trading as Peace & Co., manufacturing electrical engineer.—The first meeting of creditors was held on December 4th, at the Official Receiver's office, 191, Corporation Street, Birmingham, when a statement of affairs was produced showing ranking liabilities of £1,090, and a deficiency of £929. The debtor attributed his failure to bad trade, loss on experimental work, and bad debts. In 1923 he entered into partnership with another, putting £200 into the business. It was not successful, and in 1926 a composition of 10s. in the £ was paid. The money was advanced by a relative of the debtor's. The debtor took over the assets of the business, and carried it on under the name of Peace & Co., but he was not successful, and had only been able to continue by creating an overdraft at the bank and by borrowing. The matter was left in the hands of the Official Receiver as trustee.

H. A. LANGLOIS, trading with another as The London Electrical Co., 119, St. Mary Street, Cardiff, formerly 124, Queen Street, Cardiff, electrical engineer.—This debtor's application for discharge was heard on December 3rd at the Law Courts, Cardiff. The receiving order was made in 1926. It was reported that the debtor commenced trading on his own account in 1921 as an electrician, and in 1926 he was joined by another, but the business only lasted seven months. The concern got into debt to the extent of £1,024. It was stated that the debtor consented to judgment for £150, £50 to be paid immediately, and the balance within eighteen months. His Honour granted the discharge.

R. R. WRIGHT, trading as "Wright Bros.," 36, Normanton Road, Derby, wireless dealer.—The public examination herein was held recently at the Court House, Derby, when a statement of affairs was returned showing liabilities of £243, against assets of £146, leaving a deficiency of £97. The debtor and a relative commenced trading in November, 1924, each contributing £30 capital, and a sum of money was borrowed from their parents and put into the business. In 1925 the relative withdrew, but received no payment. The failure was attributed to depreciation of stock, want of capital, and pressure by a creditor. The examination was closed.

V. H. BATES, trading as "The Linton Radio Service," High Street, Linton, Cambs., wireless engineer.—The first meeting of creditors was held recently at the Official Receiver's Office, 41, Sidney Street, Cambridge, when a statement of affairs was filed showing liabilities ranking at £204 against assets of £56, leaving a deficiency of £148. The debtor attributed his failure to the cost of erecting a workshop, repairs of machinery, and drawings in excess of profits made. The matter was left in the hands of the Official Receiver as trustee.

A. J. COLES, Pinner Road, Harrow, electrical engineer and contractor.—The receiving order herein was made on the debtor's own petition. The first meeting of creditors was held recently at 29, Russell Square, W.C.1, when a statement of affairs was filed showing liabilities of £223, and assets estimated to produce £45, leaving a deficiency of £178.

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J. W. TURTON, electrical engineer, Market Place, Banbury.—Last day for proofs for dividend, December 23rd. Trustee, Mr. G. Mallam, Official Receiver, 37, Cornmarket Street. Oxford.

B. SMITH (H. Worton), electrical engineer, 43, Stonegate, Spalding.—Last day for proofs for dividend, December 19th. Trustee, Mr. C. E. Turton, 4 and 6, West Street, Boston.

A. SANDGROUND, wireless factor, 32, Allerton Road, Lordship Park, N.—Bankrupt discharged, subject to consenting to judgment for £40.

M. KELLY, radio apparatus dealer, 12, Jackson's Row, Manchester.—Bankrupt's discharge refused, with liberty to file a fresh application after the expiration of two years.

N. H. WOOD, electrical engineer, late of 38, St. Charles Square, N. Kensington, W.—Trustee, Mr. T. Gourlay, Official Receiver, 29, Russell Square, W.C., released November 22nd.

S. H. SKIPPER (S. H. Skipper & Co.), electrical engineer, 35, Broad Bridge Street, Peterborough.—First and final dividend of 1s. in the £, payable at the Official Receiver's office, 41, Sidney Street, Cambridge.

Company Liquidations.

PAGE ELECTRICAL EQUIPMENTS, LTD.—A meeting of members is called for January 15th at the offices of Messrs. Corfield and Cripwell, 12, Cherry Street, Birmingham, to hear an account of the winding up from the liquidator, Mr. W. Hand.

ROBINSON & HANDS ELECTRICAL CO., LTD.—A meeting of members is called for January 8th at the offices of Messrs. Poppleton & Appleby, Corporation Street, Birmingham, to hear an account of the winding up from the Liquidators, Messrs. G. W. Sparrow and Mr. F. E. Bendall.

MANCHESTER PRIVATE TELEPHONE & ELECTRIC LIGHTING CO., LTD.—First meeting of creditors and contributors December 13th, at the Official Receiver's offices, Byrom Street, Manchester.

CECIL HODGES & CO., LTD.—Last day for proofs for diivdend, December 17th. Liquidator, Mr. W. A. J. Osborne, 119, Finsbury Pavement, E.C.

DIONOID BATTERY CO., LTD.—Winding up voluntarily. Liquidator, Mr. B. C. Davies, 6, East Parade, Sheffield.

Dissolution of Partnership.

THE FALKSLEY COMPANY, electrical engineers, Great Hall Street, Derby Road, Nottingham.—Messrs. J. W. Lewsley, F V. Howitt and M. Copestake have dissolved partnership. Debts will be attended to by Messrs. Howitt and Copestake.

Trade Announcements.

Messrs. TAYLOR & PARSONS, LTD., Bond Street and Aldermansbury, Bradford, opened new showrooms last week.

Mr. FREDERICK J. WEBB, electrical and wireless engineer, Barrack Square, Chelmsford, has extended his business and opened a shop in Anchor Street; he asks for catalogues, window displays, &c.

The ELECTRO-DYNAMIC CONSTRUCTION CO., LTD., has appointed Mr. G. H. W. Gasper, 48, Palatine Buildings, Victoria Street, Manchester, Messrs. G. W. Mayle & Co., 134, St. Vincent Street, Glasgow, and Mr. D. Baldwin, 69, Albion Street, Leeds, as agents for Lancashire, Scotland and Yorkshire, respectively.

Messrs. SPICER BROS. recently opened new premises at 138, High Street, Hounslow, including an electrical showroom with a 17-ft. window. The display consists chiefly of lighting fittings.

Book Notices.

"Manual of Electrical Undertakings and Directory of Officials, 1928-29" ("Garke's Manual"). Pp. clxx+2063. London: Electrical Press, Ltd. Price 35s. net.—This very useful work of reference continues to expand as the electrical industries grow. The 32nd edition contains information regarding about 5,500 undertakings—electricity supply and electric traction, electrical manufacturing, telephone concerns, &c.—and the directory of officials occupies 270 pages. The "Progress Section" has been amplified by the inclusion of notes on power stations under construction and sanctioned, while a great deal of extra matter has been included in the "Contractors' Section."

"An Outline of Advertising," by Elwyn O. Hughes (Publicity Manager, National Benzole Products, Ltd.). 162 pp. London: Chapman & Hall. Price 7s. 6d. net.—Few people realise that there is a difference between "publicity" and advertising: the author of this book shows that there is. Briefly, publicity is merely to make a commodity known, while advertising is to make an article *desired*. It is the aim of the author to explain at least the framework of this subtle art, although, we imagine, inspiration plays a large part in successful advertising. Such questions as the various media available, the organising of advertising campaigns, the preparation of "copy" and printing technique are fully discussed, as well as a number of subsidiary matters. Advice on reading is given and a bibliography appears at the end of the book, together with a glossary of technical terms and an index.

"Electric Traction," by A. T. Dover. Second edition. Pp. xx+719; 510 figs. and 8 plates. London: Sir Isaac Pitman and Sons. Price 25s. net.

"Photoelectric Cells," by Dr. N. R. Campbell and D. Ritchie. Pp. vii+209; figs. 41. London: Sir Isaac Pitman and Sons. Price 15s. net.

"The Practice of Electrical Wiring." By D. S. Munro, M.I.E.E. Pp. xi+293; illustrated. London: The Electrical Review, Ltd. Price 4s. 6d. net.

Tube Works Re-opened.

The works of the British Mannesmann Tube Co., at Newport (Mon.) were re-opened last week, after being closed for nine days on account of a labour dispute.

New Catalogues and Lists.

HART ACCUMULATOR CO., LTD., Marshgate Lane, Stratford, E.15.—A showcard, entitled "The power behind the tone," illustrating Hart batteries, and advocating their use for all wireless circuits.

ELLMAR MOULDINGS, CO., Thimble Mill Lane, Birmingham.—List No. E.4, showing "Ellmar" mouldings in bakelite.

UNITED STEEL COMPANIES, LTD., Sheffield.—A booklet dealing with the production of pig iron at the Workington Iron and Steel Branch of the company. Illustrated.

Messrs. JOSEPH ADAMSON & CO., P.O. Box 4, Hyde, Cheshire.—A well-produced brochure recording the progress of the firm since its formation in 1874. Some excellent illustrations of the company's products and workshops are included.

MARCONI COMPANY, LTD., 210-212, Tottenham Court Road, W.1.—A showcard entitled "The world on the wings of the ether—*via* Marconi Valves," illustrating a winged lady and a Marconi valve mounted on a globe.

TYPERLITE CO., 86, Cannon Street, E.C.4.—A leaflet illustrating model No. 6 "Typerlite" desk standard.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—A December stock list of a.c. and d.c. motors.

A.E.G. ELECTRIC CO., LTD., 131, Victoria Street, S.W.1.—A stock list of the company's a.c. and d.c. motors, domestic appliances, &c.

VICKERS, LTD., Vickers House, Broadway, S.W.1.—A brochure containing lists of companies forming the Vickers group and of their products.

IRON & NICKEL BATTERY CO., LTD., 17-19, Cockspur Street, S.W.1.—A booklet entitled "Storage Batteries as a Shipboard Necessity," with particular reference to "Ionic" all-steel batteries.

ENA ELECTRICAL APPLIANCES, LTD., Ena Works, 30, Church Road, N.1.—A folder advertising "Ena" electric fires. Illustrated and priced.

SANTON, LTD., Newport, Mon.—A number of illustrated and priced leaflets drawing attention to the company's products, including "Santon" water heaters, switches, plugs, &c.

GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—An illustrated brochure containing a description of the company's research laboratories at Wembley. Also a folder containing 27 samples of the company's gelatine colour media for stage lighting, with particulars and prices.

ARCTIC FUSE & ELECTRICAL MANUFACTURING CO., LTD., Birtley, Co. Durham.—A folder giving illustrated particulars of "electro-velocity" radiators.

Messrs. W. SISSON & CO., LTD., Elmbridge Road, Gloucester.—A brochure giving brief illustrated details of Sisson engines and photographic views of the company's works.

CONSOLIDATED PNEUMATIC TOOL CO., LTD., Egyptian House, 170, Piccadilly, W.1.—Publication No. S.P.142, dealing with electric and pneumatic scaling equipment. Illustrated.

Messrs. VICKERS-ARMSTRONG, LTD., Vickers House, Broadway, Westminster, S.W.1.—A brochure in English, French, and Spanish, giving brief illustrated particulars of the company's dock equipment.

Messrs. HAGGERTY, LAWRENCE & CO., 237, Mansion House Chambers, Queen Victoria Street, E.C.4.—Leaflet No. 75, describing the Bull "Midget" light arc welder.

Calendar-blotters for December have been received from Messrs. S. ROGERS & CO., LTD., 15, Fitzroy Street, Tottenham Court Road, W.; Messrs. DE BRUNNER & LANG-SIMS, 3 & 4, King Street, W.C.2; JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, S.W.1; WARREN BROS. (MIDDLESBROUGH), LTD.; and Messrs. MAYOR & COULSON, LTD., 47, Broad Street, Glasgow, S.E.

Calendars and Diaries.

To Mr. CHARLES SELZ, 47-49, New Cavendish Street, W.1, belongs the honour of providing us with our first 1930 diary. This, as usual, is in a neat leatherette case with pockets, has a week to a page, and contains a lot of useful information.

The ASSOCIATION OF ENGINEERING AND SHIPBUILDING DRAUGHTSMEN has again sent us a copy of its diary. This is a handsomely bound little book in which the diary is prefaced by over a hundred pages of technical data and general information.

A calendar for 1930 received from Messrs. ROBERT HORNBY AND CO., LTD., 77, Dean Street, W.1, bears illustrations of the prepayment meters which the company supplies, and a block of large-figured daily slips.

The D.P. BATTERY CO., LTD., Bakewell, Derbyshire, again employs a view of the beautiful Derbyshire country for its calendar. This time it is a pastoral scene in Dovedale.

From the DUSSEK BITUMEN CO., LTD., of Sherman Street, Bromley-by-Bow, E.5, we have received one of their choice pocket diaries for 1930.

The Electrical Wholesalers' Dinner.

The annual dinner of the Electrical Wholesalers' Federation will take place on February 13th, 1930, at the Savoy Hotel, London. Sir Hugo Hirst, Bart., will be the chief guest, and it is expected that the Minister of Transport, and Mr. G. E. Cullinan (Graybar Electric Co., New York), the president of the National Electric Wholesalers' Association of America, will

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also be present. Rationalisation, it is suggested, will form the topic of the speeches. As a large gathering is expected, the secretary, Mr. James W. McKay (19-21, Hatton Garden, E.C.1), asks firms and others interested to make early application for tickets (15s. each). For the information of friends from a distance there is the inducement of railway vouchers for return tickets at single fare and a third.

For Sale.

The Disposals Committee of the North-East Coast Exhibition, Newcastle-on-Tyne, invites offers for a large quantity of electrical apparatus. (See our advertisement pages to-day.)

Recent Contracts.

Messrs. CLOUGH, SMITH & Co., LTD., have received instructions to proceed with the overhead electrical equipment of a further extension to the Darlington Corporation trolley omnibus system. This is the second repeat order placed with Clough, Smith & Co., Ltd., since the tramway system was converted by them and put into service for the operation of trolley vehicles in December, 1925. The construction of extensions to the system in Willow Road and Neasham Road were equipped and opened for service in March and April of last year. The route at present under construction is from the Market Hall to Geneva Road West, and it will form the sixth extension to the original tramway system.

The SIEMENS & GENERAL ELECTRIC RAILWAY SIGNAL CO., LTD., has been awarded a contract for the power signalling installation in connection with the electrification of the Madras suburban services of the South Indian Railway. The work comprises the supply and erection of the necessary apparatus to provide automatic signalling between Madras Egmore station and Tambaram, a distance of approximately 18 miles of double-line electrified track. The apparatus will be a.c. throughout, using colour-light signals fitted with the "S.G.E. Osram" double safety signal lamp. Continuous a.c. track circuits will be provided employing the "S.G.E." auto-bond. The equipment involved includes the following:—274 impedance bonds; 600 a.c. track and line relays; 100 multiple secondary track transformers; 180 colour-light signals (2 and 3 aspect) with necessary poles and fittings; 160 apparatus cupboards, &c., all of which will be manufactured in England in the company's associated works. The cable will be "Permanite" insulated and armoured, and will be manufactured by Siemens Bros. & Co., at their Woolwich works.

British Engineers' Association.

At the monthly luncheon meeting of the British Engineers' Association held yesterday, December 12th, at St. Ermin's Restaurant, Sir LYNDEN MACASSEY, K.B.E., K.C., was to speak on "The State and Industry."

An Echo of the General Strike.

During the general strike of May, 1926, the Hull Corporation tramway services were maintained with the assistance of volunteers. A number of these (113) were retained in the Corporation's service, and it was recently stated that their retention was a source of friction and discontent in the department. It was accordingly proposed that they should be discharged with the option of being re-engaged in the lowest positions. In spite of strenuous opposition to this measure the City Council approved it at a recent meeting, and the men concerned have been given notice terminating their employment.

Henley's Dramatic Club.

On Monday next, December 16th, at 8 p.m., at the Cripplegate Theatre, Golden Lane, E.C., Henley's Dramatic Club will present John Galsworthy's "The Skin Game."

Unemployment.

There was an increase of 11,969 in the number of persons on the registers of the Employment Exchanges in Great Britain during the week ended November 25th. At that date there was a total of 1,285,500, as compared with 1,273,531 on November 18th, and 1,395,505 on November 26th, 1928.

Scientific Management.

We have received from the International Management Institute, 154, Route de Lausanne, Geneva, some particulars of its constitution, aims and methods. The Institute is a scientific foundation established in 1927 to provide a clearing house of information regarding scientific management and a means of facilitating contacts between those interested in the subject in various countries. It also organises various special services to assist individuals or firms desirous of studying their problems on modern scientific lines. The organisations concerned in the founding of the Institute were the Twentieth Century Fund, the International Labour Office, and the International Committee for Scientific Management. Membership is divided into two classes: Any international organisation, government, public institution, professional or trade association or union can become a member subject to a minimum annual contribution of 5,000 Swiss francs. Associate membership can be attained by any institution, organisation, undertaking, or persons making a minimum annual contribution of 100 Swiss francs. The Institute has sent us a copy of its monthly bulletin, in which there appear several interesting articles on various aspects of scientific management as applied to a number of industries, as well as a useful bibliography. Accompanying this was a copy of an address by the Director of the Institute (Mr. L. Urwick, O.B.E.) on "The Training of the Business Administrator." The Institute welcomes visits from business men and women.

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.	Price Dec. 10th.	Fortnight's inc. or dec.
a	Acid, Oxalic ... ... per lb.	5⅝d.	...
a	Ammoniac, Sal ... ... per ton	£60	...
a	Ammonia, Muriate (large crystal) ,,	£52	...
a	Bisulphide of Carbon ... ... ,,	...	...
a	Borax ... ... ,,	£25	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... ... per lb.	8d. to 4d.	...
a	,, Perchlorate ... ... ,,	5½d.	...
a	Shellac ... ... per cwt.	£18 10s.	...
a	Sulphur, Commercial ... ... ,,	£11	...
a	,, Roll ... ... ,,	£11	...
a	Soda, Chlorate ... ... per lb.	3d.	...
a	,, Crystals ... ... per ton	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	3⅝d.	...
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton	£95 to £100	...
b	,, Wire ... ... per lb.	1/1 to 1/9	...
b	,, Sheet ... ... ,,	1/1 to 2/9	...
p	Babbitt's Metal and Anti-friction Metals—		
	Grade I ... ... per ton net	£165	£10 dec.
	Grade II... ... ... ,, ,,	£116	£6 dec.
	Grade III ... ... ,, ,,	£66	£2 dec.
c	Brass (rolled metal 2" to 12" basis) per lb.	10⅝d.	...
c	,, Tubes (solid drawn) ... ,,	1/0½ to 1/1	...
c	,, Wire, basis ... ... ,,	10½d.	...
c	Copper Tubes (solid drawn) ... ,,	1/3	...
g	,, Bars (best selected) ... per ton	£110	...
g	,, Sheet ... ... ,,	£110	...
g	,, Rod ... ... ,,	£110	...
d	,, (Electrolytic) Bars ... ,,	£84	...
d	,, ,, Sheets ... ,,	£143 10s.	...
d	,, ,, Wire Rods ,,	£90	...
d	,, ,, H.C. Wire per lb.	11⅝d.	...
f	Ebonite Rod... ... ... ,,	2/3 to 2/6	...
f	,, Sheet ... ... ,,	2/3 to 2/6	...
n	German Silver Wire ... ... ,,	2/2	...
h	Gutta-percha, fine ... ... ,,	nom.	...
h	India-rubber, Para fine ... ... ,,	3⅝d.	½d. dec.
i	Iron, Pig (Cleveland No. 3.) ... per ton	72/-	14/- dec.
l	,, Wire, galv. No. 8. P.O. qual. ,,	£20	...
g	Lead, English pig ... ... ,,	£22 15s.	...
g	Mercury ... ... per bot.	£23 to £23 5s.	...
e	Mica (in original cases) small ... per lb.	6d. to 3/-	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,,	10/- to 20/- & up	...
p	Phosphor Bronze, plain castings ,,	1/3½	...
p	,, ,, drawn bars & rods ,,	1/5	...
p	,, ,, rolled strip & sheet ,,	1/3½	...
p	,, ,, wire... ... ... ,,	1/6	...
o	Platinum ... ... per oz.	£13 10s.	...
d	Silicium Bronze Wire ... ... per lb.	1/2	...
r	Steel, Magnet, in bars ... ... ,,	7½d.	...
g	Tin, Block (English) ... ... per ton	£181 10s. to £182 10s.	£7 15s. dec.
n	,, Wire, Nos. 1 to 16 ... ... per lb.	8/5	1d. dec.

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

In their letter dated December 7th, Messrs. James Forster and Co. stated that the lead market was very quiet last week, with only minor fluctuations. Demand from consumers in this country continues on a hand-to-mouth basis. The Producers' Association is maintaining its price, although December lead is offering on the market at less money. Reports from the Continent, particularly from Germany, continue to be pessimistic, and prompt lead is on offer at under the Association's price. Consumption, particularly for batteries for motor cars, is bound to be affected next year by the collapse on Wall Street, while world production is steadily on the increase.

Municipal Trading at Sydney.

The *Sydney Morning Herald* says that it has been contended by the Electrical Employers' Association that the Sydney (N.S.W.) City Council is unfairly competing with its members in the sale, on time-payment, of electrical appliances. The City Commissioners reply that they have been popularising the use of electrical apparatus by the service offered to householders, and which the electrical traders had not agreed to provide.

In response to representations by the Association, the State Government has announced its intention of appointing a committee to investigate the matter. This committee will consist of one representative each of the City Council, and the Electrical Employers' Association, with a chairman appointed by the Government. It will be the duty of the committee to formulate plans for co-operation between the Council and the traders with a view to the extension of the use of electricity and electrical appliances.

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Lighting and Power Notes.

Accrington.—PROPOSED SUPPLY EXTENSIONS.—The Corporation electrical engineer has been instructed to inquire into the cost of extending the electricity supply to Huncoat, and see whether it is possible to obtain a grant from the Unemployment Grants Committee towards the scheme.

Aldershot.—TRANSFER OF UNDERTAKING.—The Parliamentary agents of the Aldershot Gas, Water, and District Lighting Company, have informed the Godalming Town Council of its intention to make application immediately to the Electricity Commissioners for a Special Order sanctioning the transfer to their clients of the Urban Electric Supply Company's undertaking at Godalming. The Aldershot company has for some time been in negotiation for the acquisition of the undertaking, but the Corporation, which has the option of purchasing it, has declined to sanction the Company's proposal.

Argentina.—FARM ELECTRIFICATION.—According to the *Review of the River Plate*, Señor Mauro Herlitzka, president of the Compañia Anglo-Argentina de Electricidad has informed the President that his company has decided to invest a large amount of capital in the country with a view to the supply of electric power over diverse and widespread areas. It is proposed to install h.p. lines for the use of pastoral and agricultural establishments. The company has already placed a line between Cordoba and Villa Maria, and this is soon to be extended to Rosario. Similar long-distance lines are to be installed in different areas of the Republic.

Barnstaple.—ELECTRICITY SCHEME.—The Town Council has applied for sanction to a loan of £4,232 for work in connection with an electricity scheme.

Barrow.—NEW PUMPING PLANT.—The Town Council has decided to install two new submerged centrifugal pumps, each having a capacity of 4,000 gal. per minute, driven by vertical electric motors, at the sewage pumping station at Salthouse at an estimated cost of between £3,000 and £4,000.

Birkenhead.—LOANS.—The Corporation Electricity Committee is to seek sanction to a loan of £21,653 for the provision and installation of a new h.p. switchboard and rotary convertor at the Bentinck Street electricity station.

Sanction has been received to loans of £2,100 for overhead extensions at Saughall Massie and Ledsham; £5,966 for overhead line extensions at Burton and Puddington; and £900 for a supply to Great Sutton.

Blackburn.—LOAN.—The Corporation Electricity Committee is applying for sanction to the borrowing of £20,000 to provide for future expenditure on electricity mains and services.

Blackpool.—NEW CABLES.—The Corporation is applying for sanction to loans totalling £7,550 for feeder cables.

Bolton.—NEW WATER COOLING PLANT.—The Corporation Electricity Committee has decided to install additional water cooling plant of the sprayer type, capable of dealing with 750,000 gals. per hour, at the Back-o'-th'-Bank generating station.

Bristol.—EXTENSION OF SUPPLY AREA.—The Corporation is applying for sanction to extend its area of electricity supply to include Henbury and Bishopsworth.

Bury.—YEAR'S WORKING.—We have received from Mr. J. G. Potts, engineer and manager of the Corporation Electricity Department, a copy of the accounts together with his report on the working of the undertaking for the year ended March 31st last. The total revenue amounted to £125,693, as compared with £116,899 in the preceding year, while the working expenditure (which included £12,759 contribution to capital) totalled £83,561, as against £74,068. To the gross profit of £42,132 (£42,831) was added £139 unemployment grant, £1,753 bank interest and £1,357 from sale of plant, making a total of £45,382 available. From this the following items had to be met:—Interest on loans, £18,977; sinking fund contribution, £17,845; bank interest, £534; and transfer to sinking fund, £1,357. There remained a net surplus of £6,669, as against £5,995 in 1927-28. The capital expenditure during the year amounted to £59,694, the principal item of which was £30,561 for plant, machinery, &c., at the Chamber Hall power station. The total now spent on the undertaking stands at £673,055. The electrical energy sold increased from 25,270,672 to 27,232,015 kWh and the maximum supply demanded from 10,840 to 12,320 kW. The average price obtained per kWh fell from 1.067d. to 1.060d. Satisfactory progress has been made with the extensions to the power station plant and it is anticipated that the installation of the new 10,000-kW turbo-alternator and boiler plant will be completed in time for next winter's load.

Canada.—HYDRO-ELECTRICAL PROGRESS.—In October the Canadian Hydro-Electric Corporation, Ltd., produced 208,661,000 kWh of electrical energy, which is 39 per cent. above the output for October of last year, and 20 per cent. above the figure for September. The output of the Corporation for the twelve months ended October 31st was 2,002,406,000 kWh, an increase of 75 per cent. as compared with the output for the corresponding period of 1927-28.

Continental.—SWEDEN.—The Waterfall Board (Vattenfallstyrelsen) is asking the Government to propose to the next Riksdag the construction of a hydro-electric power station at Vargoen on the Goeta river, on which the big Government-owned Trollhaettan power station is situated. The cost of the new station is estimated at Kr. 9,400,000. With a fall of 3.3 metres, the output will be 85,000,000 kWh per annum, but later, after the regulation of Lake Vaener, the source of the Goeta river, has been completed, and the fall increased by one metre, the output will be 115,000,000 kWh.—*Reuter's Trade Service* (Stockholm).

BELGIUM.—In order to meet the increasing demand for electrical energy, a new 10,000-kW turbo-generator set is approaching completion at the power station at Monceau of the Société Intercommunale Belge d'Electricité, and next year two 4,000-h.p. turbo-generators are to be installed. A new 15,000-h.p. turbo-generator set is also being installed at the company's power station at Alost, while orders have been placed for an additional 30,000-h.p. set for the station at Bressoux.

GERMANY.—According to *E.T.Z.*, the output of the 122 principal electric power stations in Germany during August last amounted to 1,435,400,000 kWh, bringing up the total for the first eight months of the year to 10,735,700,000 kWh, as compared with 9,091,300,000 kWh in the corresponding period of 1928.

Dunoon.—ELECTRICITY SUPPLY.—The Provisional Order for the supply of electricity to the town has been passed, and an immediate start will be made with the work. Plans for the erection of the power station have been passed by the Dean of Guild Court and it is expected that the supply will be available next summer.

Eastbourne.—AREA OF SUPPLY.—At a meeting of the Corporation Electricity Committee held recently, the chairman reported his further interview with representatives of the Electricity Commission on the subject of the division of territory in the Eastbourne rural district for the purposes of electricity supply, and a letter was read from the Electricity Commission stating that the promoters of the Ringmer and District Special Order have agreed to withdraw the parishes of Wilmington, Folkington, Jevington, Friston and East Dean from their application. These parishes will, therefore, be included in the Eastbourne Extension Order, and the following parishes will be excluded from it, *viz.*:—Alfriston, Alciston, Berwick, Litlington, Lullington, Selmeston and West Dean.

LOAN.—It was reported that in anticipation of the granting at an early date of the application by the Corporation for a Fringe Order to give a supply to certain premises in East Dean and Friston, the Finance Committee had decided to seek sanction to the borrowing of £11,430.

REVISED TRANSMISSION-LINE ESTIMATES.—At a recent meeting of the Corporation Electricity Committee, the town clerk reported that, in accordance with the Committee's instructions, revised plans and estimates dealing with the substitution of underground for overhead transmission lines had been lodged with the Electricity Commissioners. The total estimated capital expenditure for underground transmission is £11,430, and overhead transmission, £6,800.

ELECTRICITY SUPPLY EXTENSIONS.—The Committee has decided to carry out extensions for a supply of electricity to Lower Willingdon, at an estimated cost of £616.

Erith.—NEW PLANT.—The Urban District Council has applied to the Electricity Commissioners for sanction to expend from the reserve fund, instead of out of a loan, a sum of £3,361 for cable, switchgear and transformers.

Fairlie.—INAUGURATION OF SUPPLY.—The Earl of Glasgow performed the ceremony of switching on the electricity supply for the village on Saturday last. To celebrate the event the principal street of the village was illuminated.

Hebden Bridge.—BULK SUPPLY.—The Urban District Council has approved a draft agreement with the Halifax Corporation for a further bulk supply of electricity.

Heston & Isleworth.—LOANS.—The Urban District Council Electricity Committee is to apply for sanction to loans of £30,989 for l.p. distribution mains, and £2,550 for replacement of consumers' apparatus.

Hull.—ELECTRICITY SUPPLY.—The Corporation Electricity Committee proposes to erect an overhead line from Sutton to Skirlaugh to give a supply of electricity to the Hornsea area. The estimated cost of the scheme, inclusive of provision for a supply to Swine and Skirlaugh, is £15,186. The erection of the overhead line portion of the scheme is to be carried out by the Department's present contractors for overhead lines, Messrs. Watshams, Ltd., of London.

Ilkley.—UNDERTAKING PURCHASE OFFER REJECTED.—The Urban District Council has rejected an offer by the Yorkshire Electric Power Co. to purchase the Council's electricity undertaking, to take over also the obligation of the outstanding loans, and to make an immediate reduction in the charges for electricity.

Lancaster.—ELECTRICITY SUPPLY SCHEME.—The Corporation Electricity Committee has instructed the electrical engineer to prepare a scheme for supplying electricity to Galgate, Halton, Caton, and Brookhouse, with a view to application for an unemployment grant.

Leeds.—LOANS SANCTIONED.—The Corporation Electricity Committee has obtained sanction to loans of £175,000 for services and £50,000 for assisted wiring.

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Lincoln.—EXTENSION OF SUPPLY AREA.—The Corporation Electricity Committee has considered a report of the electrical engineer with respect to a request for a supply of electricity to houses to be erected on Greetwell Road, and recommends that part of the proposed inner h.p. feeder ring from St. Swithin's power station to Brayford be laid as far as Greetwell Road, the estimated cost being £3,800.

Llanelly.—GALE DAMAGE.—According to the *Daily Mail*, the electricity supply was cut off for nearly four hours when a portion of the 120-ft. high stack of the Llanelly and District Electric Supply Co., Ltd., was blown down and fell into the engine room of the power station shortly after 6 p.m. last Sunday.

Llanidloes.—SPECIAL ORDER.—The Llanidloes Electric Light Co., Ltd., has applied to the Electricity Commissioners for a Special Order authorising it to supply electricity in the borough of Llanidloes, and certain parishes in the rural district of Newtown and Llanidloes.

London.—PRICE REDUCTION.—The South Metropolitan Electric Light and Power Co., Ltd., has decided, after the December meter readings, to make the following reductions in the charges for electricity in the Greenwich and Crystal Palace districts, including the Blackheath and Lewisham areas:—Lighting, flat rate: From 6d. to 5½d. per kWh. The "unit" charge for "all-in" domestic and business supply two-part tariff: From 1d. to ¾d. per kWh.

The South London Electric Supply Corporation has also made the following reductions in charges:—Lighting, flat rate: From 6d. to 5½d. per kWh. The "unit" charge for the "all-in" domestic and business supply two-part tariff: From 1d. to ¾d. per kWh.

STREET LIGHTING.—Lord Byng, Police Commissioner, recently issued a circular letter to all the municipal authorities in London calling for more light in the streets. The letter suggested that many street accidents have been directly due to inadequate lighting arrangements. "Lord Byng's object," an *Evening News* correspondent was told, "was to get the local authorities to co-operate with the police and the Ministry of Transport in promoting public safety."

Macclesfield.—PROPOSED PURCHASE OF UNDERTAKING.—The Town Council has appointed a committee to consider and report as to the purchase of the undertaking of the Electricity Company of Macclesfield, Ltd., and other matters which may arise in connection with the electricity supply within the borough.

Maidstone.—LOANS SANCTIONED.—The Town Council has received sanction to loans of £25,000 for mains and services, and £11,683 for mains, services, and works for the supply to the Malling district.

Manchester. — DOMESTIC TARIFF ALTERATION. — The City Council has adopted a resolution proposed by the Electricity Committee to substitute present ratable value for "pre-war values" in fixing the basic charge for the "all in" tariff for domestic users, subject to an amendment that there should be a reduction in the tariff from 15 per cent. of the ratable value to 12½ per cent.

STREET LIGHTING.—The Council has decided to light the following roads by electricity: Kenmere Grove, Moston Lane; Greenhill Road and Balliol Street, Crumpsall; School Lane, Kingsway and Willoughby Avenue, Didsbury; and Clare Road, Levenshulme.

Oswestry.—PURCHASE OF UNDERTAKING.—The Town Council has decided to purchase the undertaking of the Oswestry Electric Lighting and Power Co., Ltd., for £19,300, and to apply for sanction to a loan of £22,000 in connection therewith.

Plymouth.—NEW PLANT.—The Corporation Electricity Committee has decided to expend the following sums on plant at the Prince's Rock power station:—Turbo-alternator and foundations, £42,500; boilers, chimney, &c., £39,333; feed and circulating pumps, &c., £4,200; circulating water screens and chamber, £3,080; steam and other piping, £4,400; switchgear, £8,713; cables, £900; conveyor, £1,200; and battery room, £1,974.

LOAN SANCTIONED.—The Electricity Committee has received sanction to the borrowing of £65,000 for mains and services.

Retford. — RURAL SCHEME SANCTIONED. — The Electricity Commissioners have sanctioned the Town Council's scheme for supplying Tuxford and the rural area with electricity, and the work is to be commenced without delay.

Sheffield.—MAINS EXTENSIONS.—The Corporation Electricity Committee has authorised mains extensions to cost £8,525.

Stafford.—TRANSFER OF UNDERTAKING.—The Town Council has approved proposals for the transfer of the Corporation generating station to the North-West Midlands Joint Electricity Authority for £166,015.

Stoke-on-Trent.—MAINS EXTENSIONS.—The Corporation Electricity Committee has decided to extend mains to the works of Bullers, Ltd., at Milton, at a cost of £3,500; from the Porthill sub-station to the works of Jesshopes, Ltd., at an estimated cost of £1,200; to the factory of Messrs. Beesons, at a cost of £280; and, subject to a satisfactory guarantee being received and to an agreement being entered into with the North West Midlands Joint Electricity Authority, to the colliery of the Eaves Lane Coal and Marl Co., at a cost of £1,000. A sum of £6,500 has also been voted for mains and equipment in connection with the supply to the Springfield Tileries of Wheatley & Co. at Stone Road, Trent Vale.

LOAN.—The Corporation Electricity Committee is to apply for sanction to the borrowing of £5,000 for the changing-over of consumers' apparatus.

SUB-STATION EQUIPMENT.—The Committee has decided to provide and equip a sub-station in the Hanley works, at a cost of £2,000, and to install additional plant at East Fenton and Minton's sub-stations, at a cost of £600.

Tilbury.—LOAN INQUIRY.—An inquiry was held on December 3rd by Col. T. C. Ekin into the application of the Urban District Council for a loan of £44,362 for electricity purposes. The inspector stated that he had gone into the figures and found that the sum really required by the Council was £46,707, and, if so, the Council would have to pass a resolution amending the amount. The inspector criticised the loss on the undertaking, and said that he thought some charge ought to be made for meters. There was no opposition, and it was arranged that the Council should send certain supplementary information regarding the sum required.

Tiverton.—FLOOD DAMAGE.—It is feared that the Corporation's new generating plant, which was started up recently by the Mayoress, has been considerably damaged by flood waters.

Ulverston.—ELECTRICITY SUPPLY PROGRESS.—At a recent meeting of the Urban District Council, it was stated that there was an increase in the consumption of electricity for last month of 39.3 per cent. as compared with November, 1928, and an increase of 30.5 per cent. for the eleven months ended November 31st.

Wakefield.—UNDERTAKING NOT TO BE SOLD.—The City Council at a meeting held recently again considered the offer of the Yorkshire Electric Power Co. to take over the city's electricity undertaking, at the price of £250,000, "plus a substantial sum," which would probably bring the figure nearer £300,000, and to reduce the charges for electricity forthwith. The offer had been declined by a previous meeting, but the matter was raised on the minutes of the General Purposes Committee by further correspondence from the company. Opinion in the Council—especially in view of the fact that Wakefield Corporation has lost some £340,000 in the Hatry companies crash—was so keenly divided that the vote on an amendment to refer the matter back for further negotiations showed 20 on each side. The Mayor declined to give a casting vote, and therefore the amendment failed, and the minute rejecting the offer was approved.

Wimbledon.—NEW PLANT.—To meet the growing demand for electrical energy, the Corporation Electricity Committee has decided to provide a 5,750-kW turbo-alternator with switchgear and auxiliaries.

LOAN SANCTIONED.—The committee has received sanction to a loan of £30,000 for electricity mains and services.

Tramway and Railway Notes.

Brazil.—RAILWAY ELECTRIFICATION.—The Paulista Railway Co. is about to construct five side tracks at its Jundiahy station-yards and extend and partly re-equip the shops at that junction.—*Reuter's Trade Service* (Sao Paulo).

Bury.—EXPERIMENTAL TRAMCAR HEATING.—The Corporation Tramways Committee is experimenting with a system of electric heating of the tramcars. Pipes run along a portion of each side of the car, each containing 250-volt elements in series, the electrical energy being supplied by the overhead wires; where the pipes pass between seats they are covered with a metal grid to protect the feet and ankles of passengers. The enclosure of the elements in a metal pipe, which enables the heat to be retained for a considerable period, even when the electricity has been turned off, and this allows some regulation of the car heating. The tramway manager is experimenting with an alternative system before making his final recommendation to the Tramways Committee for general adoption on all the cars.

Continental.—HUNGARY.—The Hungarian State Railways have invited tenders for the first part of the work of electrifying the Budapest-Hegyeshalom line (the Hungarian section of the Budapest-Vienna line). The total amount involved exceeds 12,000,000 pengoes (about £430,000) of which 2,800,000 pengoes (£100,000) will go to the purchase of electric locomotives.—*Reuter* (Budapest).

ITALY.—At the end of June last 1,012 miles of the Italian State main line railways, representing 1,973 miles of track, had been electrified. At the date mentioned 290 miles of line, representing 426 miles of track, were in course of electrification, while electrification plans were being prepared

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in respect of a further 363 miles of line. According to *L'Elettrotecnica*, the consumption of electricity for the operation of the electrified Italian State railways in the fiscal year 1927-28 amounted to 296,700,000 kWh.

Darlington. — RAILLESS-CAR SYSTEM EXTENSION.—At a recent meeting of the Town Council it was decided to proceed as quickly as possible with the projected extension of the railless-car system from the Market Place to Geneva Road by way of Blackwellgate, Grange Road, and Victoria Road.

Gosport.—TRAMWAY ABANDONMENT.—The Gosport and Fareham Tramways Co. has decided to discontinue its tramway service as from January 1st next, and to substitute 'buses.

The Great Western Railway.—PROPOSED ELECTRIFICATION SCHEME.—The Great Western Railway Company is stated to be considering a scheme for the electrification of railways in the Bristol area at a cost of between £1,000,000 and £2,000,000. The lines said to be involved in the proposed scheme are: (*a*) Bristol to Avonmouth, *via* Clifton Down and Shirehampton; (*b*) Bristol to Portishead; and (*c*) Bristol to Weston-super-Mare.

Walsall.—TRAMWAY ABANDONMENT.—The Corporation has prepared a Bill to empower the Corporation to purchase compulsorily or by agreement the part of the tramway of the South Staffordshire Tramways Co. from the boundary between the borough and the urban district of Darlaston to the Bull Stake, Darlaston, and the part of the tramway of the Wednesbury Corporation from the boundary between the borough and the borough of Wednesbury to the "White Horse," Wednesbury, and to empower the Corporation to abandon the tramways connected therewith and to substitute 'buses.

Telegraph and Telephone Notes.

Canada.—TELEPHONE SERVICE.—The Bell Telephone Co. expects, during the next five years, to spend on extensions and replacement 160 million dollars and to install 250,000 telephones in the provinces of Ontario and Quebec, says the *B. of T. Journal*. Since the present operating organisation was established six years ago, its investment in telephone plant in service has grown by more than 106 per cent., the total at present being 144 million dols. The number of telephone stations has increased by 61.4 per cent. to the present total of 739,000; annual additions to plant have grown by 137.3 per cent. to 29 million dols. in 1929, and the number of employés has risen from 12,700 to 19,200, an increase of 61.2 per cent. The general executive headquarters are at Montreal, but in 1930 there will be two independent operating areas, each with its own general manager and complete administrative and engineering staffs. Toronto will be the headquarters of the western area, while Montreal will be the headquarters of the eastern division. The Bell Co., though the largest, is not the only concern controlling telephones in Canada, the number of separate organisations being nearly 2,500, many, of course, operating in very restricted areas.

Radio-telephony.—INTERNATIONAL POLICE SERVICE.—The private broadcasting police "net," which embraces Austria, Germany, Poland, and Czecho-Slovakia has been inaugurated. Hungary is expected to join shortly, and Roumania is co-operating to some extent, while Switzerland and Dantzig also will be included shortly.

The Telephone Service.—POLICE BOXES.—The first network of special police telephone boxes which is being erected throughout the metropolitan police area of 700 square miles recently came into use at Richmond, Kew, and Barnes. All the 22 boxes are connected directly with the divisional police station at Richmond. The telephone, which is contained in a cupboard in the box, can be used by anyone requiring police assistance.

The ordinary instrument has been replaced by a fixed microphone and loud-speaker in the system just installed at Rochdale. The device is based on the supposition that people calling for police assistance are usually agitated, and should be freed from any possible entanglement. The earpiece and cord have therefore been dispensed with, and the opening of the small door giving access to the instrument automatically sets up communication with headquarters.

CARRIER-WAVE SYSTEM.—It is reported that the carrier-wave system of speech transmission is being applied to the Blackpool-Isle of Man submarine telephone cable.

STORM DAMAGE.—Post Office linesmen have been busy during the last two weeks of gales and thunderstorms in South and South-West England. Several hundred trunk and local circuits were interrupted, overhead lines being broken in many cases by falling trees and roof tiles. Telegraph communication between the Channel Isles and the mainland was completely interrupted, no telephone cable being available. Similar stormy conditions have prevailed in France too.

Radio Notes.

Brookman's Park.—SECOND TRANSMITTER.—In addition to the 356.3-metre transmitter, the second transmitter commenced a schedule of test transmissions on December 9th on a wavelength of 261.3 metres, twice daily of half an hour each. If the shorter-wave radiation is of the same power as the longer one attenuation will probably cause the signal to be weaker at a distance. In adjusting receiving sets it should be remembered that the Leeds station is at present working on 200 metres and that about a year hence the separation between Brookman's Park and Daventry (5 GB, 479.2 m.) may be decreased.

During the test programmes the 356.3-m. transmission consisted of speech only, to be readily distinguishable from the new transmitter, which operated for a time without the complication of the presence of the longer-wave radiation. The eventual national, or general interest, service (maximum radius from 50 to 60 miles) will be provided by Brookman's Park (261.3 m.) and Daventry (5XX, 1,554.4 m.), while the Brookman's Park (356.3 m.) radius will be about 80 miles.

Germany.—NEW STATIONS.—Important decisions were reached at a meeting of broadcasting representatives at the Funkhaus in Berlin on November 27th, when it was announced that the reorganisation of the German system had been approved in principle. It is understood that a number of super-stations (seven or eight) will be built to replace the present main stations, which are situated in or near the large towns, after the Langenberg model, in open country. Simultaneously there will be created a parallel system of low-power stations for "single-wave" working. The power of the new stations will probably be 60 kW with the possibility of being raised to 100 kW, which figure is the maximum agreed to at the recent Hague session of the International Consultative Technical Committee. The stations will cost about 16,000,000 marks (£800,000) each. The first two may be about twenty miles distant from both Stuttgart and Frankfurt, and *World-Radio* thinks it is possible that the reorganisation of the system will be finished within two years.

PICTURE TRANSMISSION.—The poor response to an inquiry has led to the decision to terminate the experimental transmission of still pictures from the Berlin stations.

International Broadcasting Union.—RED CROSS MESSAGES.—Representatives of the organisations composing the International Broadcasting Union recently attended a conference at Barcelona, Spain. One of the questions on the agenda was wireless broadcasting in connection with disasters. Red Cross representatives were invited to take part in the discussions, and, in view of the studies it is making for the preparation of the International Relief Union, the secretariat of the League of Nations also took an active part in the proceedings. After receiving the different reports presented on the subject, the Council of the International Broadcasting Union unanimously decided to recommend that broadcasting organisations and Government departments should study and establish agreements with national Red Cross Societies granting special facilities to such societies in respect of their communications, and priority over all broadcasting, in the event of public disasters.—*Reuter's.*

Nickel and its Uses in Engineering.

Lecturing recently before the Junior Institution of Engineers, Mr. W. T. Griffiths stated that prior to the 1914-18 European war 65 per cent. of the world's production of nickel was utilised in the manufacture of nickel steel for armament purposes, but that after the armistice production dropped to the level of the years 1890-91. New uses had since that period increased the consumption to as high a figure as any attained during the war. A considerable portion of the output was used for parts of wireless valves and also for the electrodes of sparking plugs. It was largely used by electro-deposition for building up worn parts of mechanisms, but its principal uses were for alloying with other metals.

When alloyed to iron to the extent of about 25 per cent. nickel destroyed its magnetic properties, but strangely enough a higher percentage of nickel restored those properties, and the Western Electric Co. of America had proved that after the heat treatment of high-content nickel-iron alloys, their magnetic qualities were from 10 to 13 times better than those of the best soft iron; it also had much effect in diminishing the hysteresis loss. Those properties were of much use in submarine communication cable manufacture. In heat resisting steels it prevented corrosion up to temperatures of 600 or 700 deg. C. Nickel-chromium alloys were now largely used for electrical heating purposes, and when alloyed with copper it increased the tensile strength of the latter from 21 to 45 tons per square inch; it was now greatly used for condenser tubes. Nearly all the nickel used in the world came from within the Empire, Canada producing 90 per cent. of it; there were also small deposits in New Caledonia.

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Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—Posts and Telegraph Department. January 7th. Telephone hand sets. (B.X. 5823.)* Contact pressure testers. (B.X. 5821.)*
January 14th. Ringing motor-generator sets for automatic telephone exchanges. (B.X. 5839.)* Telephone indicators. (B.X. 5822.)*
January 28th. Induction coils and register plates. (B.X. 5899.)*
February 25th. Jumper rings and terminal strips. (B.X. 5941.)*
January 7th. Telephone cable and terminal boxes. (B.X. 5938.)
February 18th. Jacks and number plates. (B.X. 5940.)*
January 13th. State Electricity Commission of Victoria. 2,200-V switchgear and accessories. (B.X. 5827.)*

Bolivia.—A *Reuter's Trade Service* message from La Paz says that the Municipal Council of Llallagua (Department of Potosí) will shortly invite tenders for electrical plant to supply light and power to the town. The first contract will be for a maximum period of ten years. Llallagua is the centre of the Bolivian tin-mining industry, some of the largest mines in the world being situated there.

Bradford.—December 31st. Corporation. Electric passenger and goods lifts. City architect, Town Hall, Bradford.

Dartford.—December 21st. Urban District Council. Supply and delivery of 3,400 yd. of 0.1 sq. in. 3-core ,11,000-V cable. (See this issue.)

Denmark.—COPENHAGEN.—Lighting Department. One 10,000-kVA oil-cooled transformer with pumps, motors, &c. (B.X. 5945.)*

Egypt.—CAIRO.—December 28th. Ministry of Public Works. Electric generating and pumping sets for Mankabad Barracks. (B.X. 5842.)*
February 1st. Ministry of the Interior. Centrifugal well pump and direct coupled electric motor with piping and accessories. (A.X. 8811.)*

Glasgow.—December 18th. Education Authority. Installation of electric lighting in two schools. Specifications (21s.) from the Education Offices, Bath Street.

Halifax.—Town Council. December 21st. Electrician's work in connection with the erection of Girls' High School, Craven Lodge. Specifications, &c. (deposit £2 2s.) from Mr. A. C. Tipple, borough engineer.

India.—December 20th. Bombay, Baroda & Central India Railway Co. Supply of glass boxes, plates and wood separators for accumulators. (December 6th.)

Kirkcaldy.—December 18th. Education Authority. Electrical and heating work, at additions to St. Agatha's R.C. school, Methil, and Bell-Baxter school, Cupar. Schedules (deposit £1 1s. each) from Mr. E. Sandilands, architect and master of works, Education Offices, Kirkcaldy.

Liverpool.—December 23rd. Electricity Supply Department. Supply of twelve 750-kVA transformers. (See this issue.)

London.—CENTRAL ELECTRICITY BOARD.—December 21st. Supply, delivery and erection of 132,000-V transformers for the Mid-East England Electricity Scheme, 1929. (November 22nd.)
January 6th. Supply, delivery, and erection of 132-kV overhead transmission lines (special crossings and high spans), for the North-West England and North Wales Electricity Scheme, 1928. (November 29th.)
January 20th. Supply, delivery and erection of 3,300-V, 6,600-V and 11,000-V switchgear for connecting the Board's supply to undertakers' busbars, North-West England and North Wales Scheme. (See this issue.)
ISLINGTON.—January 9th. St. Mary Parish Guardians. Supply and erection of five automatic electric lifts at the Infirmary, Highgate Hill, N. (December 6th.)
January 17th. Electrical and engineer's stores for one year commencing April 1st next. (See this issue.)
METROPOLITAN ASYLUMS BOARD.—January 2nd. Alterations to electric lighting installation at the South-Western Fever Hospital, London Road, Stockwell, and installation of car-washing and disinfecting apparatus at Brook, North-Western, South-Eastern and South-Western ambulance stations. (December 6th.)
January 2nd. Replating a 500-ampere-hour electrical storage battery at St. Luke's Hospital, Lowestoft. (See this issue.)

Maidstone.—December 21st. Committee of Visitors. Electrical installation for lighting, heating, &c., at the Mental Hospital, Barming Heath. (See this issue.)

Manchester.—Electricity Committee. December 17th. Supply and erection of one 6,600-V sheet-steel type transformer kiosk and switchgear. (November 29th.)

Millom.—December 20th. Urban District Council. E.h.p. and l.p. cables, pillar box, &c., and e.h.p. and l.p. switchgear, transformer, &c., for the Haverigg extension scheme. (November 22nd.)

Morocco.—December 17th. Post and Telegraph Authorities of Morocco at Rabat. Supply of 2 tons of copper wire, 2 mm. dia., and 75 tons of high-conductivity copper wire, 2 mm. dia.

New Zealand.—WELLINGTON.—Post and Telegraph Department. January 13th. Four point jacks. (B.X. 5840.)*
January 16th. Telephone switchboard plug covers. (B.X. 5879.)*
January 21st. Spare parts for automatic telephones. (B.X. 5917.)* Reed-type tension gauges. (B.X. 5918.)*
Public Works Department. January 14th. Two air compressors and two electric motors. (A.X. 8784.)*
January 28th. Three 50-kW oil-immersed circuit breakers for Arapuni. (B.X. 5878.)*
Four electric motor-driven ventilating fans. (A.X. 8857.)*

South Africa.—PRETORIA.—December 27th. Posts and Telegraph Departmnt. Telegraph material. (A.X. 8734.)*
BLOEMFONTEIN.—January 10th. Electricity Supply Department. Automatic electric traffic signals. (B.X. 5887.)*
JOHANNESBURG.—January 4th. Stores Department. Automatic traffic signals. (B.X. 5924.)*
CAPE TOWN.—January 7th. Electricity Department. Supply of 3-core 11,000-V cable. (B.X. 5925.)*

Stoke-on-Trent.—December 31st. North-West Midlands Joint Electricity Authority. Supply and erection of e.h.p. and l.p. overhead transmission lines. (See this issue.)

Wakefield.—December 18th. West Riding Mental Hospital Board. Wiring for electric light, Wadsley Mental Hospital, near Sheffield. Mr. W. E. H. Burton, West Riding Mental Hospitals Board, Wakefield.

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Australia.—SYDNEY.—New South Wales Government Railways.
Two induction voltage regulators (£2,495).—Horrocks Roxburgh Pty., Ltd.
Switchgear for Wyangala (£51,105).—Australian General Electric Co., Ltd.
Municipal Council.
Underground h. and l.p. cables (£16,950).—Enfield Cable Works, Ltd.
MELBOURNE.—State Electricity Commission of Victoria.
Steam turbo-generators, with condensing plant, for Yallourn power station extensions (£148,375).—Metropolitan-Vickers Electrical Co., Ltd. —*Tenders.*

Barrow.—Electricity Committee. Accepted:—
Renewal of lighting battery (£1,397).—Tudor Accumulator Co., Ltd.

Blean.—Board of Guardians. Accepted:—
Electric lamps for six months.—Amalgamated Lamp Co.

Bradford.—Tramways Committee.
100 steel tramcar tires (£336).—English Steel Corporation, Ltd.
100 steel tramway poles (£600).—Stewarts & Lloyds, Ltd.
Electricity Committee. Accepted:—
Boiler feed-pump suction piping for the Valley Road power station.—E. & W. H. Haley, Ltd.

Braintree.—Board of Guardians. Accepted:—
Installing electric lighting at the Institution.—East Anglian Co.

Brighton.—Watch Committee. Accepted:—
Traffic signals at Old Steine (£764).—Brighton Lighting and Electrical Engineering Co., Ltd.
Lighting Committee. Accepted:—
One 200-kVA transformer (£185).—Ferranti, Ltd.

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Bristol.—Education Committee. Recommended:—
Electrical work at secondary school, Cosham (£560).—J. H. Winter & Co.

Burnley.—Electricity Committee.
Public address amplifying apparatus (£129).—Standard Telephones & Cables, Ltd.

Burton-on-Trent.—Electricity Committee. Accepted:—
Apparatus for metering sub-station (£834 plus £50 for erection).—Metropolitan-Vickers Electrical Co., Ltd.

Chesterfield.—Electricity Committee. Accepted:—
One truck-type 6,600-volt cubicle (£132).—British Thomson-Houston, Ltd.
One 150-kVA transformer (£110).—Brush Electrical Engineering Co., Ltd.

Dysart.—Town Council. Accepted:—
Electric lighting installation for the housing scheme (£115). Martins, Ltd.

Eastbourne.—Electricity Committee. Accepted:—
H.p. cable (£5,612).—Pirelli-General Cable Works, Ltd.
Two transformer kiosks (£1,049).—General Electric Co., Ltd.

Henley-on-Thames.—Town Council. Accepted:—
Installing electric lighting at the Kenton Hall, including footlights.—S. Bennett.

Hull.—Telephones Committee. Recommended:—
Insulators (£129).—Equipment and Engineering Co., Ltd.
Three tons bronze wire (£326).—T. Bolton & Sons, Ltd.
Tramways Committee. Accepted:—
440 yd. l.p. cable (£143).—Siemens Bros. & Co., Ltd.

Leeds.—Electricity Committee. Accepted.
Sub-station fuse panels (£346).—Yorkshire Switchgear and Engineering Co., Ltd.
Cables:—(£1,824), W. T. Henley's Telegraph Works Co., Ltd.; (£1,611), Enfield Cable Works, Ltd.; (£4,280), Macintosh Cable Co., Ltd.; £1,156), Hackbridge Cable Co., Ltd.; (£1,995), Derby Cables, Ltd.
Sewage pumping plant (£310).—Hathorn, Davey & Co., Ltd.

London.—LEWISHAM.—Works Committee. Recommended:—
Electrical installation at depôt garage.—A. J. Hewens and Sons.
SOUTHWARK.—Electricity Committee. Recommended:—
Feeder pillars.—W. Lucy & Co., Ltd.
Cables (£3,067).—Derby Cables, Ltd.
METROPOLITAN WATER BOARD.—Accepted:—
Switchboard at Kempton Park waterworks.—W. Lucy and Co., Ltd.

Manchester.—Transport Committee. Accepted:—
Electric overhead travelling crane.—S. H. Heywood & Co., Ltd.
Two rail planers.—Equipment & Engineering Co., Ltd.
One Crypto battery charging equipment.—Lancashire Dynamo & Motor Co., Ltd.
Electricity Committee. Accepted:—
Steam pipework.—Henry Tattersall, Ltd.
Two 10,000-kVA transformers.—Ferranti, Ltd.
33,000-V, 3-phase switchgear.—Ferguson, Pailin, Ltd.

Oldham.—Electricity Committee. Accepted:—
Overhead line equipment.—W. F. Furse & Co.

Plymouth.—Electricity Committee. Accepted:—
Sub-station gear (£561).—English Electric Co., Ltd.
Electric lamp columns (£125).—Bromford Tube Co., Ltd.
Works Committee. Accepted:—
Battery for electrically propelled vehicle (£220).—Transport Department.

Salford.—Finance Committee. Accepted:—
Equipment for private automatic branch telephone exchange (£668).—General Electric Co., Ltd.
Conservancy Committee. Recommended:—
Electrical balancing and operating gear at sewage works (£140).—Whitehead & Poole, Ltd.
Education Committee:—
Electric lighting installations:—Halton Bank School (£212).—J. Price & Sons.
London Street School (£150).—County Electrical Co. (Pendleton), Ltd.

Sheffield.—Electricity Committee. Accepted:—
Four 500-kVA transformers (£696).—Hackbridge Electric Construction Co., Ltd.

Sleaford.—Electricity Committee. Accepted:—
Switchgear.—General Electric Co., Ltd.
Public lighting cable.—Callender's Cable and Construction Co., Ltd.

West Fife.—Infectious Diseases Hospital Committee.
Electric lighting installation for the extension of the West Fife Infectious Diseases Hospital (£685).—Alex Rolland and Co.

West Ham.—Board of Guardians.—CORRECTION.—The contract for the fire alarm at Whipps Cross Hospital was awarded to F. Hodgson & Co., Ltd., and not "F. Hodgson," as stated in our last issue.

Wimbledon.—Electricity Committee. Recommended:—
Soot and grit prevention plant (£2,400).—Pneumatic Conveyance & Extraction, Ltd.

Forthcoming Events.

Association of Mining Electrical Engineers (Lothians Branch).—Saturday, December 14th. Lecture on "Transformers," by Mr. P. Butlter.

Nottingham Society of Engineers.—Monday, December 16th. Technical College, Derby. 7.30 p.m. Joint meeting with the Derby Society. Lecture on "Rationalisation of Industry," by Mr. L. C. Ord.

Association of Supervising Electrical Engineers.—Tuesday, December 17th, Junior Institution of Engineers, 39, Victoria Street, S.W., 7.15 p.m. "Synchronisation of Films and Speech." Mr. S. S. A. Watkins.

Edinburgh Electrical Society.—Wednesday, December 18th, 16, Royal Terrace, Edinburgh. "Electric Traction." Mr. J. S. Ross.

Electrical Power Engineers' Association (Manchester Technical Group).—Wednesday, December 18th. Geographical Hall, Manchester. 7.15 p.m. "Developments in Power Station Condensing Plant." Mr. H. L. Guy.

Overhead Lines Association.—Wednesday, December 18th. Institution of Electrical Engineers, Savoy Place, W.C.2, 5.30 p.m. Discussion on "Some Continental and British Methods Compared," to be opened by Mr. Theodore Rich.

Institution of Electrical Engineers.—Thursday, December 19th. Institution, Savoy Place, W.C., 6 p.m. "The Heating of Buildings Electrically by means of Thermal Storage," Lieut.-Col. S. E. Monkhouse, R.E., and Mr. L. C. Grant; and "The Heat Pump—an Economical Method of Producing Low-Grade Heat from Electricity," Mr. T. G. N. Haldane.

(Scottish Centre).—Monday, December 16th. Royal Technical College, Glasgow, 7.30 p.m. "Surges and Over-Voltage Phenomena on Transmission Lines due to Lightning and Switching Disturbances." Dr. H. Norinder.

(Hampshire Sub-Centre).—Thursday, December 19th. Municipal College, Portsmouth, 7.30 p.m. "Naval Wireless Telegraphy Communications." Mr. G. Shearing and Capt. J. W. S. Dorling, R.N.

(Sheffield Sub-Centre).—Wednesday, December 18th. Royal Victoria Hotel, Sheffield, 7.30 p.m. "Public Street Lighting," &c. Mr. J. F. Colquhoun.

(Tees-side Sub-Centre).—Wednesday, December 18th. Cleveland Technical Institute, Middlesbrough, 7 p.m. Ordinary meeting.

(North-Western Students' Section).—Tuesday, December 17th, Engineers' Club, Manchester, 7.15 p.m. "Some Problems in Industrial Control Gear." Mr. J. M. Gillespie.

(South-Midland Students' Section).—Thursday, December 12th. University, Birmingham. 7.30 p.m. Film meeting.

Junior Institution of Engineers.—Friday, December 20th, 39, Victoria Street, S.W., 7.30 p.m. "Line Signalling on the Southern Railway." Mr. W. Challis.

British Electrical Development Association.—Friday, December 20th, Royal Society of Arts, John Street, Adelphi, W.C., 7.30 p.m. Display of Electrical Kinematograph Films.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of makers of the following:—

GOEBEL paper slitter.
CAMERON paper slitter.
Paper cutters used with those named above in cable-making processes.
Electrically-driven cake mixers (must be small).
Vulcanised fibre boards marked "V.F.Ld."
Electrically-operated novelties for shop-window use and obtainable on hire.

Modern Welding Systems.

In lecturing on this subject recently before the Junior Institution of Engineers, Mr. W. C. Freeman reviewed the advantages of the oxyacetylene flame and the electric-arc as the sources of heat in welding operations. One advantage of electric spot welding over gas welding was its greater cheapness, it being stated that at 1d. per kWh 1,000 spots on 20-gauge steel would cost one penny.

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Notes.

The Batti-Wallah's Society Luncheon.

Mr. V. Watlington, M.B.E., was the principal guest of the Batti-Wallah's Society at its luncheon held at the Hotel Cecil on December 5th. The chairman, Mr. H. L. HOWARD, presided over an attendance of about 140 members and guests. In his address, which followed the loyal toast, Mr. WATLINGTON referred to the effect on the commercial fortunes of Great Britain, of its peculiar geographical position as an island, no point of which was more than 100 miles from the sea, as compared with distances up to 2,000 miles in some other countries. This physical feature made it possible to export goods with a minimum cost for transport. In return, imports were required, and we had deliberately chosen to buy our food. The result was that our agriculture had been almost destroyed, and 80 per cent of our population were living in towns. There was now a feeling that to pay low wages on the strength of low food costs was unsatisfactory. The electrical industry was new and free from the traditions that hampered some of our older trades. Germany was now for the first time exporting a larger proportion of the total value of electrical exports than Great Britain, and there was a danger that this position might become stabilised through the reparation payments. The dominions represented by far our biggest market, but the best preference was to sell what people wanted at the right price. He expressed the view that the unemployment problem could be brought nearer to solution if we were more optimistic. Unemployment schemes should enable each man to do work of a kind with which he was familiar. Thus, for electrical development, miners could lay cables, while one ton of coal would be needed for every ton of ducts used. Only 4 per cent. of the men engaged in the electrical industry was unemployed, but there was loss through under-production.

There was much ignorance regarding the meaning of rationalisation, such as was shown in a letter in the "Correspondence" columns of the ELECTRICAL REVIEW of November 29th. Rationalisation was really the rationing of demand according to output, enabling the more efficient plant to be operated to the best advantage. It had been adopted in Germany, and had brought that country out of a state of bankruptcy. Great Britain had been slower than any other country in recovering from the effect of the war.

Thanks to the speaker were proposed by Mr. W. E. LANG, who spoke of the harmful effects abroad of depreciatory references to our efforts.

Mr. M. WHITGIFT (hon. secretary) announced that any change in ownership of the Hotel Cecil would not affect the arrangements made for the annual dinner and dance of the Society on March 21st next.

Cost of Production at Selected Stations.

The following are the principal points contained in the Electricity (Allocation of Cost of Production) Regulations, 1929, dated November 13th, 1929, made by the Electricity Commissioners under the Electricity (Supply) Act, 1926. (H.M. Stationery Office. Price 1d. net.)

The average load factor of a selected generating station shall be obtained by multiplying the number of units of electricity supplied from the station during the year of account by 100, and dividing the product by the average monthly maximum demand multiplied by the number of hours during which fuel was being consumed in the station for generating electricity or for maintaining the plant in readiness to generate.

The average monthly maximum demand shall be the arithmetical average of the monthly maximum demands on the station in those calendar months during which the station was in commission. The monthly maximum demand on the station shall be twice the largest number of units of electricity supplied from the station during any consecutive thirty minutes from the commencement or from the middle of any hour.

"Cost of fuel" shall mean the sums expended for fuel consumed plus the cost of any transport, handling, preparation, or treatment incurred in connection with the delivery of the fuel to the boiler hoppers or furnaces, and in connection with the disposal of the products or residues of combustion, together with the proper proportion of salaries and wages and any contributions for pensions, &c., less any sums received from the sale of any products or residues of combustion.

Of the following costs of production of electricity at a selected generating station shall be allocated as Fixed Costs:—(*i*) All costs incurred in rents, rates, taxes, management, establishment charges, other revenue expenditure, and interest on capital expenditure on generating plant. (*ii*) Of the works costs portions calculated from the formulæ for ascertaining the portion to be allocated as fixed costs:—

Cost of fuel; 100/100+12.8 L. Cost of oil, water and stores; 100/100+9.66 L. Salaries and wages; 100/100+0.38 L. Cost of repairs, maintenance and renewals; 100/100+0.0001 N L, where L is the average load factor of the station, and N is the number of hours during which the station was in commission in the year of account. The remainder of the costs shall be allocated as running costs.

These Regulations shall not apply to hydro-electric stations or where the circumstances are such that the Regulations could not reasonably be applied.

Power Factor and Price for Supply to Selected Stations.

The following are the principal points contained in the Electricity (Adjustment of Price according to Power Factor) Regulations, dated November 13th, 1929, made by the Electricity Commissioners under the Electricity (Supply) Act, 1926. (H.M. Stationery Office. Price 1d. net.)

The power factor at which a selected generating station is operating at the time of maximum demand on the station (or the power factor of the supply from a selected generating station to its owners at the time of the owners' maximum demand upon the station) shall be obtained by dividing twice the largest number of units of electricity supplied from the station (or to the owners) during any consecutive thirty minutes by twice the number of kilovolt ampere-hours supplied from the station during the same thirty minutes from the commencement or from the middle of any hour.

The adjustment for power factor shall be effected by multiplying such fixed kilowatt charges component by a coefficient calculated from the following formula:

$$\frac{0.8 + \frac{0.2}{B}}{0.8 + \frac{0.2}{A}},$$

where A is the power factor (expressed as a decimal) at which the selected generating station is operating at the time of maximum demand upon the station; and B is the power factor (expressed as a decimal) of the supply from the selected generating station to the owners thereof at the time of the owners' maximum demand upon the station.

These Regulations shall not apply to a hydro-electric station or where the circumstances are such that the Regulations could not reasonably be applied.

A Lighthouse Appeals for "Bart's."

A lighthouse was switched on by the Prince of Wales at St. Bartholomew's Hospital last week, to broadcast the special appeal for £1,000,000 for the reconstruction fund. The lighthouse is an actual lighthouse made by Collier & Co., who have lent it to the hospital for the purposes of the appeal. It is fixed at the top of the new surgical and operation treatre block, and is about 120 ft. above ground level. The lamp is a 5,000-W 200-V Philips' lamp of the standard type, and is fixed cap upwards. No measurement of the actual candle power of the beam has been made, but it is estimated to be approximately 750,000. The beam has been seen as far off as Bedford.

A Colliery Explosion.

Reporting on the explosion at the Milfraen Colliery, Blaenavon, Monmouthshire, where nine persons lost their lives on July 10th last, the Divisional Inspector of Mines attributes the explosion to the defective condition of the cover of an electric coal-cutting machine. He stated, according to the *Daily Telegraph*, that the examination made by the electrical staff appeared to be of a haphazard order, and the general maintenance of the plant was poor in consequence. Had the machine been carefully examined, the loss of a number of set-screws and the ill-fitting condition of the semi-circular cover of the machine would have been noted and remedied. As to the origin of the disaster, Mr. J. Macleod Carey expresses the opinion that gas was ignited by sparking at the switch within the electric coal-cutting machine; and, owing to the defective condition of the cover of that machine, flame was emitted and ignited gas outside the machine. The inspector enumerated five breaches of the Coal Mines Act of 1911, or of the general regulations, as having been committed by the management of the colliery.

Lighting Accessories.

Members and friends of the Association of Supervising Electrical Engineers attended an interesting lecture, by arrangement with the General Electric Co., Ltd., at Magnet House, London, on December 3rd when Mr. F. G. Quance dealt with "Recent Developments in Lighting Accessories with Special Reference to the Increasing Use of Insulating Material in Place of Metal." The lecture was fully illustrative of accessories usually employed in average installations, such as fuseboards, tumbler switches, wall sockets and plugs, ceiling roses, lampholders, &c., bearing on present-day practice. Mr. H. W. Roberts presided, and refreshment provided by the company was served during an interval in the proceedings.

The Incorporated Municipal Electrical Association.

The November Report (Vol. 10, No. E7) to members of the I.M.E.A. contains several items of interest to electricity supply engineers, including an account of a discussion with the Electricity Commissioners regarding change-overs from d.c. to a.c. distribution, with particular reference to the laying of new 4-core cables, and some points in favour of 3-wire single phase cables are mentioned. An account of a conference with the Central Electricity Board, on the question of liability for the cost of substituting switchgear of higher rupturing capacity than is possessed by the existing installations due to connection to the Grid, is also of topical interest. Under the heading of "Electricity for Domestic Purposes," reference is made, *inter alia*, to the need for statistics which would enable the progress made to be realised more closely.

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Electrical Developments at Inverness.

On December 11th the Bught hydro-electric station of the Royal Burgh of Inverness electricity undertaking (engineer, Mr. Cecil Allan Grut) was officially inaugurated. The hydro-electric plant consists of a vertical turbine, manufactured by Messrs. Boving & Co., Ltd., directly coupled to a vertical generator by Metropolitan-Vickers Electrical Co., Ltd. The turbine is of the single-runner propeller type, operating on a varying head from 9 ft. 6 in. to 6 ft. 6 in., and runs at 250 r.p.m. The quantity of water passing through the turbine is regulated by means of a very sensitive oil-pressure governor, of Messrs. Boving & Co.'s manufacture, which is operated by means of oil at a pressure of 150 lb. per sq. in.

Direct current is generated at 480/560 volts, and, as the supply is given on the three-wire system, a middle wire static balancer has been installed, capable of dealing with 15 per cent. of the full load of the machine. The switchboard, also supplied by Metropolitan-Vickers, is entirely automatic in its operation. Once the water has been turned on and full speed attained, the automatic switchgear comes into operation, regulates the voltage, closes the main switch, puts the machine on load, and regulates the output according to the demand on the system. In actual practice it has been found extremely satisfactory, and during the trials it has run for many days on end without human supervision in any way. Protective devices are fitted, so that should a bearing become overheated, or the governor belt break, the plant is immediately shut down automatically before any damage is likely to be done. The total cost of the scheme is approximately £15,000, and, although the original estimate of output was 450,000 units per annum, it is anticipated that the output will be something like 600,000 units per annum.

This plant, which is capable of supplying the night demand between the hours of midnight and 7 a.m. during the winter, and 6 p.m. and 7.30 a.m. during the summer, will enable the steam generating station at Waterloo Place to be shut down during these hours, thus affecting considerable economies in coal, wages, &c. The current leaves the power-house by means of two overhead lines, one of which crosses the river near the Ness Islands and connects into the cable network in Island Bank Road. The bulk of the current, however, passes by means of an overhead line and underground cable to a distribution pillar, which has been erected near the Infirmary Bridge, and from this point the current is fed into the cable network on both sides of the river, as well as into Culduthel Road.

On the same day a refuse power installation, to work in conjunction with the electricity works, was also opened. This consists of two 2-cell trough grate units, each unit of two cells being complete with its own forced draught fan, electrically-driven charging gear, and combustion chamber. Between these two units is placed a Babcock & Wilcox water-tube boiler with an evaporating capacity of 12,000 lb. of steam per hour. The Underfeed Stoker Co., Ltd., was entrusted with the order for the mechanical stoker, which is of their newest "L" type. Forced draught is provided by means of an electrically-driven fan, and overhead coal bunkers are fitted, the coal from the bunkers passing through a chute to an automatic weighing-machine into the stoker hopper. The steam from the boiler is conveyed across the road to the electricity works by means of a 6-in. steam main, suitably lagged and suspended from gantries supported by suitable lattice steel towers. The condensate from the generating plant at the electricity works is conveyed back underneath the intervening road into the hot-well tank in the destructor works.

Mining Electrical Engineers' Dinner.

The annual dinner of the West of Scotland Branch of the Association of Mining Electrical Engineers was held in Glasgow on December 7th; Mr. G. N. Holmes, the local chairman, presided. Prof. Howe, of Glasgow University replying to the toast of "The Guests," referred to the opposition of the coal industry to the Grampian water-power electricity scheme, and said there was a curious fallacy about that water-power cost nothing. For that matter neither did coal, so long as one left it alone. In use one was likely to cost as much as the other.

Electricity Charges in Wandsworth.

As a sequel to the inquiry held in July into the charges made for electricity in Wandsworth by the London Electric Supply Co., Ltd., the Minister of Transport has made an Order reducing the maximum price which the company may charge for electricity to 5d. per kWh as from the December quarterly readings, and reducing the minimum quarterly charges to 6s. 3d. in each of the winter quarters, and to 4s. 2d. in each of the summer quarters. The County of London Electric Supply Company has announced that as from the December quarterly meter readings the lighting flat rate of 5½d. per kWh will be reduced to 5d. per kWh in those areas of the company within the Administrative County of London. In addition to the districts mentioned above, this announcement includes Dulwich, Roehampton, Southwark, Camberwell, Bermondsey, Clerkenwell, Finsbury, and Holborn.

Lots Road Mishap.

A defect at the Lots Road generating station disorganised a large part of the London Underground electric railways on Wednesday morning last. The trouble is said to have been due to a cable defect, which occurred at 7.12 a.m., and all trains stopped for some time.

Appointments Vacant.

Mains superintendent for Barnes Urban District Council. Meter repairer and tester for Peterborough Corporation. Telegraph foremen for the Government of the Gold Coast. Engineering assistant for sub-stations for Hull Corporation. Junior charge engineer for Barrow-in-Furness Corporation. Cable-jointer and electrician for Holywood Urban District Council. (See our advertisement pages to-day.)

Electricity Supply Rifle League.

Members of the above-named League foregathered on November 30th at the Talbot Restaurant, London Wall, for their annual dinner and presentation of prizes.

Mr. R. S. Downe (Brompton and Kensington) presided over the gathering, which numbered 79 diners, and after dinner a successful concert was provided by various members and friends of the clubs concerned, under the able direction of Mr. A. Allsup.

Smethwick Fire Disaster.

The attention of the Council of the Institution of Electrical Engineers has been drawn to newspaper reports of the proceedings at the inquest, which concluded on the 25th September last, upon eleven persons who lost their lives by reason of a fire at premises in Rolfe Street, Smethwick, on September 2nd.

Some of the evidence purported to show that the fire was due to a defective electrical installation in a neighbouring building, and in this connection one of the witnesses condemned the use of lead-covered rubber-insulated cables for the wiring of public buildings. This statement has caused great uneasiness in the minds of consulting engineers, architects, electrical contractors, and others, inasmuch as the use of lead-covered rubber-insulated cables is permitted by, and the proper methods of installation of such cables are set out in, the "Regulations for the Electrical Equipment of Buildings" issued by the Institution. These Regulations are recognised by consulting engineers, electrical contractors, electricity supply authorities, and the Fire Offices, as representing the best standard practice, and the Fire Offices in particular recommend their use.

The Council re-affirms, therefore, that it is of the opinion that lead-sheath cables are both suitable and safe for electrical installations, if installed and maintained in accordance with the I.E.E. Wiring Regulations.

Rural Electrification.

Mr. J. H. Thomas and Mr. George Lansbury recently received a deputation from the Rural Reconstruction Association on the subject of "Agriculture and Unemployment," at the House of Commons. Mr. R. Borlase Matthews advocated the need for rural electrification on the basis that (*a*) it would mean immediate work for many of the workless; (*b*) it would cause many of the town toilers to go back to the land, as the actual work of equipment would give employment in both town and country; and (*c*) it would convert farming from a peasant pastime into an important business. The area supplied by the electricity mains of each town should be extended until it met the areas supplied by the mains of adjoining towns. A practical remedy would be: (1) a survey of the electrical distribution system of the country, with a view to the allotment of rural areas to those adjoining electricity suppliers who were technically and commercially best able to serve them; (2) after allotment, to see that the responsibility was undertaken adequately to supply each rural area with electricity. For the benefit of the management of most urban electricity supply undertakings, existing experience of rural electrification (of which a considerable amount was available) should be collated and analysed and then put into such shape as would facilitate the acquisition of the necessary knowledge of the subject. The Government should consider the following recommendations and, when possible, introduce some form of legislation to deal with them:—

(1) Some form of long-term loans at low rates of interest in the initial years should be arranged for the construction of rural lines, for until load was developed as a result of educational work it was extremely difficult to make the lines remunerative.

(2) Those authorities which obtained such loans should be compelled to undertake educational publicity campaigns in the use of electricity in rural areas, and commence repaying their loans as soon as revenue permitted.

(3) Those undertakings now holding Orders to supply in rural areas should be compelled to prepare schemes which would fit in with the national programme of development of rural areas.

(4) Vested interests, from wayleaves upwards, should not be allowed to hold up such schemes of public service.

(5) Overhead lines should be erected with no more restrictions than were considered necessary in the case of any other public utility service.

(6 An inquiry should be held into the procedure of the Electricity Commissioners.

(7) At least one member of the Electricity Commissioners should be an expert in rural electrification, and should be given sufficient authority to take such action and employ such civilian staff as might be deemed necessary to produce effective results as quickly as possible.

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London Subway Conference.

A conference of all the authorities interested in the provision of subways for mains under streets is suggested by the General Purposes Committee of the L.C.C. to consider the Holborn explosions, which occurred some months ago. It is suggested that the people to be invited to the proposed conference should include representatives of the L.C.C., the Postmaster-General, Minister of Transport, Commissioner of Metropolitan Police, Commissioner of City of London Police, Corporation of the City of London, the Metropolitan Boroughs Standing Joint Committee, the Metropolitan Water Board, and representatives of various electricity, gas, and railway companies. The committee further suggests, according to the *Evening News*, that the question of holding a Government inquiry into the London subway question should be considered, if necessary, after the conference.

International Illumination Congress.

Illumination Engineering Societies exist in Great Britain, United States, Germany, Austria, Holland, and Japan; and everywhere organisations are developing which aim at bringing about better lighting. The movement towards international treatment of the subject had its origin in the International Photometric Commission, founded in 1901, and in 1913 effect was given to that desire by the reconstitution of the Commission on a wider basis as the International Commission on Illumination, to which are linked National Committees in all the chief countries of the world. Meetings in Paris (1921), Geneva (1924), Bellagio (1927), and New York (1928), revealed continuous progress. The International Illumination Congress and the session of the Commission held in the United States last year probably formed the most important conference on lighting matters ever held, and was attended by 500 delegates from Austria, Belgium, France, Germany, Gt. Britain, Holland, Italy, Japan, Sweden, Switzerland, and the United States.

The next International Illumination Congress is to be held in Great Britain in 1931. In this country the machinery for the study of illumination is perhaps more perfectly organised than in many other places, and the aid of all the leading scientific and technical bodies interested in, and of organisations concerned with, gas and electric lighting is being secured. The National Illumination Committee of Great Britain, in co-operation with the Illuminating Engineering Society, will be responsible for this important event, and several committees are already at work on the arrangements. The Congress will take place from September 3rd to 13th, 1931, and will be combined with a *voyage d'etude* to places of interest in England and Scotland, so that other cities beside London will share in the work of the Congress. Papers dealing with the most varied aspects of lighting will be presented and so grouped as to ensure that topics of special local interest will be dealt with at each centre. The Congress will be followed by the technical meetings of the International Commission on Illumination, which will be held at Cambridge from September 13 to 19th. The hon. general secretary of the Congress is Colonel C. H. Silvester Evans, Illuminating Engineering Society, 32, Victoria Street, London, S.W.1.

Northampton Polytechnic Conversazione.

The annual prize distribution and conversazione were held at the Polytechnic, Clerkenwell, on December 6th and 7th. On Friday a report on the work of the session was presented by Mr. S. C. Laws, M.A., M.Sc. (principal), and this was followed by an address by Mr. H. A. Game, M.A., chairman of the governing body, and the presentation of prizes and certificates by Mrs. Game. The presentation was preceded and followed by organ recitals by the Polytechnic organist, Mr. S. Dicker, and, as in preceding years, the laboratories, workshops, &c., were opened for inspection by visitors. On Saturday, the programme was continued, when an excellent promenade concert was given by the Polytechnic Choral and Operatic Society and the Polytechnic Orchestra. Gymnastic, badminton, boxing, and swimming displays were also given, and the function was brought to a successful conclusion with dancing.

Extensions at Ashford.

The electricity undertaking of the Ashford (Kent) Urban District Council has made very good progress since its inception three years ago, and reference to this enterprise was made recently, when there was officially started up a new 1,350-h.p. Diesel solid-injection oil engine which, with super-charger, is capable of an output of 900 kW. The engine, which has been supplied (with an alternator by the English Electric Co., Ltd.) by Messrs. Davey, Paxman & Co., Ltd., is the first of its type, it is claimed, to be installed in an electricity station in this country. Last year Ashford had the honour of having the first 600-kW engine of its type in the country, also supplied by Messrs. Davey, Paxman. The Council started its undertaking three years ago with three 400-kW sets, and now has plant with a total capacity of 2,700 kW. It has applied to the Electricity Commissioners for another engine to be installed next summer. The available space in the works will then have become occupied, and the probability is that further supplies in excess of what the undertaking produces will be taken from the Central Electricity Board. In the year ending March, 1928, the undertaking generated 1,854,000 units, which was increased in the following year to 2,915,000 units, whilst it is anticipated that in the current year the undertaking will generate 4,225,000 units. About fifty miles of cable have been laid and further extensions are in hand. A supply is given to the Southern Railway works at Ashford and to neighbouring villages. Customers are being added at the rate of 70 per month.

When the new plant was started up by the wife of the electrical engineer, Mr. H. Wilson, A.M.I.E.E., tributes were paid to the department, and especially to the engineer. Mr. Edward Paxman said that last year the firm supplied the Council with what was the largest engine of its type in the country. Now, practically within twelve months, they were starting up an engine fully 33 per cent. bigger in capacity, but taking no more space and having greater efficiency. Once again this would be the largest of its type in the country. Ashford's progress was probably unparalleled. Speeches were made by various representatives, including the vice-chairman of the Council, who stated that the average cost of 1.72d. to consumers was below that of a number of larger towns in Kent. The new plant, with the alternator, cost £7,798.

Great Indian Peninsula Railway.

At the inauguration of the G.I.P. main-line electrification (Bombay to Poona section) by his Excellency the Governor of Bombay (Sir Frederick Sykes), the special train, made up of the new articulated Poona mail train, the coaches of which were finished in aluminium picked out with red (only possible with electric traction), was on its outward journey hauled by two of the largest G.I.P. steam express locomotives, suitably decorated for the occasion, the leading engine being "Hero," the war memorial engine hitherto always used on such occasions, but now thus employed probably for the last time.

Dining coaches made up a 350-ton train, and four hours were taken to complete the journey, which was not too comfortable, as, according to the *Times of India*, a wind conspired with the locomotive to deposit the largest possible amount of ash and dirt on the seats and floors of the coaches and their passengers.

After the ceremony in Poona, the Governor's coach was also attached to the train, bringing up the weight to 450 tons, which the electric locomotive hauled home at the maximum permissible speed in one hour less than the outward journey, and with, of course, complete freedom from smoke and dirt.

Sir Frederick Sykes pointed out that Bombay, as the gateway of India, had to distribute an immense transit traffic, and the electrification would accelerate the process.

Mr. D. S. Burn, Agent of the G.I.P. Railway, said that the newly electrified main line would give the G.I.P. Railway the greatest length of electrified main line in the British Empire, and would constitute one of the most important main-line electrifications in the world. He enumerated the many advantages of electrification, among which were: freedom from smoke in towns and tunnels; improved train service, both as regarded speed and frequency; increased carrying capacity of line, without costly additions to the permanent way, due to the possibility of hauling heavier trains at higher speeds; reduced cost of haulage as compared with steam traction; reduction in wear and tear of rolling stock, owing to the employment of regenerative braking; reduced liability of locomotive failure or loss of time on locomotive account; economy in coal consumption and the utilisation of lower-grade coal in the power house; and freedom from the anxiety about failure of water supply.

Mr. Burn went on to describe how in order to ascertain the best type of passenger locomotive for use under Indian conditions, three different types were ordered, the result being that an order for the 22-passenger locomotives, each weighing 102 tons, was placed with the Metropolitan-Vickers Electrical Co., Ltd., which also supplied the 41 to 120-ton freight locomotives for the same line.

The Electrical Association for Women.

On November 27th, Mr. E. E. Sharp gave a very interesting lecture to members at their London Club Room, 46, Kensington Court, on some of his electrical experiences in Australia and New Zealand.

The Association has just concluded a most successful series of three evening lectures at the Club Room by Mr. H. Bourne, of the Hendon Electric Supply Co., Ltd., on "How electric heaters, cookers, and cleaners are wired, and why they get out of order; the construction, use, and maintenance of electric kettles, toasters, irons, and other small apparatus; and practical hints about bells, batteries, and wireless sets." On each occasion the lecturer brought with him samples of the apparatus under discussion, which were taken to pieces, every point being discussed and criticised by the lecturer and the audience. Mr. Bourne stressed the importance of having all-electric appliances in the bathroom fixed and earthed, and further urged that radiator connections should be strongly constructed and the earth wire visible throughout its length.

A successful dance and whist drive was held recently at Bristol by the Bristol and District Branch of the E.A.W., at which there was an attendance of 120 members and friends.

On November 26th members of the Birmingham and Midlands Branch of the Association spent an interesting afternoon at the showrooms of Frigidaire, Ltd., Birmingham, and on December 4th a successful bridge and whist drive was held at the Grand Hotel by the same branch.

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Institution Notes.

Institution of Electrical Engineers.

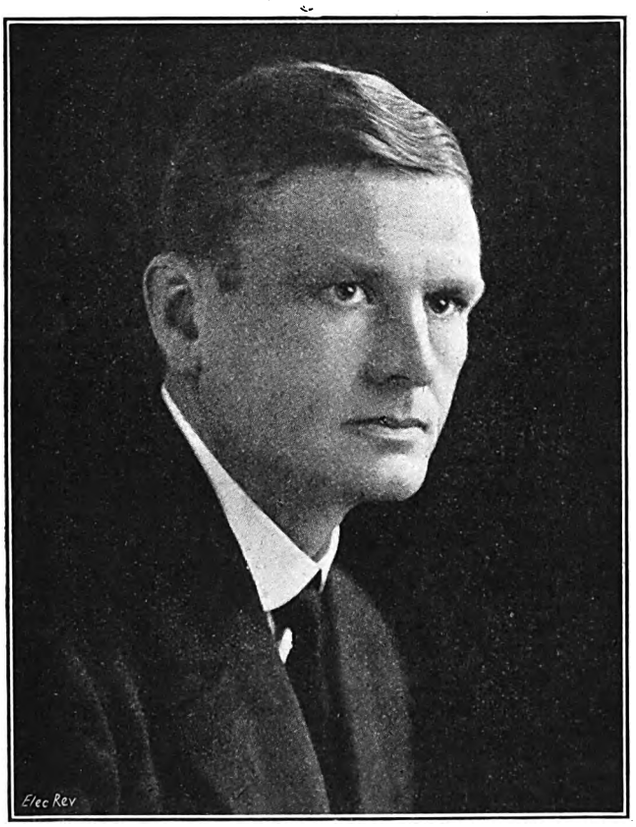
IRISH CENTRE.—For the purpose of creating interest and attempting to form a students' section, members in Northern Ireland met last week in Belfast in the physics lecture theatre of Queen's University. The lecturer was Mr. T. J. Monaghan, M.I.E.E., chairman of the Irish Centre, and Mr. F. H. Whysall, M.I.E.E., city electrical engineer, Belfast, presided. It was the first meeting of northern members to be held in Belfast since the war. Mr. Monaghan dealt with the risk taken in electrical working and, comparing it with the risks of all other forms of industry and sport, showed by figures from England, U.S.A., Holland, &c., that the death-roll per year from electrical causes was much lower. Mr. Whysall said the headquarters of the Irish Centre were in Dublin, and as a consequence the meetings of the committee of the local section and its ordinary meetings were held there. Several attempts had been made to bring the members in Northern Ireland into closer touch with the Centre, but it was very difficult for Ulster members to make the journey to Dublin and attend the meetings regularly. One serious consequence was that young engineers who were eligible as student members, and who were situated in Northern Ireland, did not join the Institution, but he was strongly of opinion that it would be in their best interests to do so, even under existing circumstances.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

We are anxious to correct any wrong impression that may have been conveyed by our use of the term "full-time" secretaryship in our leaderette of last week (p. 982) on the annual festival of the Electrical Trades Benevolent Institution. Mr. F. B. O. HAWES never was a "full-time secretary" for the Institution. In May last year we referred to his splendid work in performing "the full secretarial duties" and that is what we really intended to convey last week. Nobody remembers or appreciates better than ourselves the very fine services that Mr. Hawes rendered to the E.T.B.I. over a period when the industry made various other important demands upon his time. For many years prior to 1928 he held the honorary secretaryship, and he did so until he retired from business and from that position early this year, as, being resident away from London, he felt he could no longer be of service even in an advisory capacity to the Fund.

We are able this week to reproduce a photograph of Mr. F. FORREST, who, as we have already reported, is to succeed Mr. R. A. Chattock as City Electrical Engineer of Birmingham. After serving a five years' apprenticeship with Messrs.



Beaufort] *[Birmingham.*

Mr. F. Forrest, M.I.E.E.

The prospective City Electrical Engineer of Birmingham.

Siemens Bros. & Co., Ltd., and passing through their various departments, Mr. Forrest was on the engineering staff of the yacht *Alberta*, belonging to King Leopold II of Belgium. He held that position for eighteen months, and then was chief assistant engineer to the Tynemouth Corporation for nine months. Subsequently he became assistant station engineer to the Charing Cross Company, and remained with that concern for 4½ years. His connection with the Birmingham undertaking commenced in 1906, when he was placed in charge of the Sub-Stations Department. During a period of eleven years Mr. Forrest was also responsible for the whole of the electrical plant and switchgear installed in the generating stations. He has been chief assistant to Mr. Chattock for the past 12 years; during that period the output and maximum load has more than doubled. Last year he visited many of the large undertakings in the United States and Canada on behalf of the Birmingham Corporation; in the previous year he had made a similar inspection of power stations in Germany. Mr. Forrest is a past-chairman of the Midland Centre of the I.E.E.; he is a member of the Institution of Mechanical Engineers, and also of the American Institute of Electrical Engineers.

Reuter states that Sir WILLIAM HALDANE has paid a visit to Czecho-Slovakia to study the electrification of agriculture in that country.

Sir GILBERT C. VYLE has been re-elected president of the British Engineers' Association for the year 1929-1930.

The Oldham Corporation Tramway Committee has appointed Mr. J. F. RICHARDS as general manager of the Corporation Tramway Department at a commencing salary of £650 per annum, rising to £750 per annum, and Mr. A. HENTHORN, chief clerk, as deputy general manager at a salary of £412 per annum.

The Bradford Tramways Committee recommends that Mr. N. A. SCURRAH, technical assistant, be appointed works superintendent in the Tramways Department, at a commencing salary of £400 per annum.

The *Evening Standard* of December 9th reported that in the early hours of the previous Saturday Mr. W. BEAVIS, works manager of the Newhaven and Seaford Electricity Co., was called out to attend to a slight mishap at the power station. He has not been seen since, but the wreckage of a car believed to be Mr. Beavis's has been recovered from the sea. It is surmised that the force of the gale wrenched the steering wheel from Mr. Beavis's hands and that the car was blown over the sea wall.

Mr. CHARLES E. D. GREENHALGH, deputy electrical engineer at Watford, is recommended by the Ilkley Electricity Committee for appointment as electrical engineer to the Urban District Council.

The Bedford Town Council has appointed Mr. H. W. MILLATT, showroom manager in the Chester Electricity Department, as sales engineer for the rural electrification scheme, at a salary of £400 per annum.

Following the resignation of Mr. H. W. LAING, tramway manager at Lytham-St. Annes after 23 years' service, several departmental heads are passing into retirement shortly. These include Mr. J. PARTINGTON, rolling stock superintendent (27 years' service), Mr. P. PARTINGTON, tramway electrical engineer (26 years' service), Mr. J. WALSH, storekeeper (26 years' service), and Mr. T. BARON, permanent-way engineer (17 years' service).

The *Electrical World* states that Mr. SAMUEL INSULL, president of the Chicago Edison Co. and other electrical enterprises, celebrated his 70th birthday on November 11th.

A financial daily states that Mr. MAX BYNG has joined the board of "Phantestra" (Renn's Gramophone and Wireless), Ltd.

The London County Council Highways Committee recommends that Mr. J. H. PARKER, West Hartlepool borough electrical engineer and general manager of transport service, be appointed electrical engineer in the Council's tramway

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department at a salary of £1,700 a year. A photograph of Mr. Parker, together with an account of his career, appeared in the ELECTRICAL REVIEW for August 7th, 1925 (p. 225), when he vacated the post of deputy electrical engineer at Croydon to go to West Hartlepool.

Mr. JAMES O'BEIRN, M.B., D.Ph., of Galway, has been appointed a director of the Marconi International Marine Communication Co., Ltd.

Obituary.—SIR ASHTON LISTER.—We regret to learn of the death, on December 6th, of Sir Ashton Lister, founder of Messrs. R. A. Lister & Co., Ltd., of Dursley. He was 84 years of age, and received his knighthood in 1911.

MR. J. C. NICHOLSON.—We regret to report the death, at the age of 69 years, of Mr. John Charles Nicholson, head of the firm of Messrs. Jenson & Nicholson, vanish manufacturers, of Stratford, London. He passed away last Saturday.

MR. T. DODD.—It is reported in the Press that Mr. Thomas Dodd, a pioneer X-ray worker at Newcastle, has died from the effects of permatitis contracted thirteen years ago.

Wills.—Mr. HERBERT SEFTON-JONES, chartered patent agent, left £17,068 gross and £12,895 net personalty.

Mr. J. C. D. JONES, formerly electrician-in-chief to the Eastern Telegraph Co., Ltd., at Singapore, who died recently at the age of 77 years, left £47,307 net and £47,587 gross personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Bel-Canto Radio Reproducer Co. (N.S.), Ltd.—Private company. Registered December 3rd. Capital £1,100 in 100 ordinary, and 1,000 7½ per cent. cumulative preference shares of £1 each. Objects: To carry on the business of manufacturers of and dealers in all kinds of apparatus for wireless transmission and reception, &c. The permanent directors are:—S. W. Mosby, address not stated; R. C. Byng, Kingsmead, Winkfield, Windsor; J. B. Blakeborough, Woodleigh, Brighouse; A. E. C. Harvey, address not stated. Solicitors: Simpson, Curtis, Dixon & Burrill, Leeds.

Mortimer, Gall & Co., Ltd.—Private company. Registered December 3rd. Capital, £500 in £1 shares. Objects: To carry on the business of electrical and general engineers and contractors, manufacturers of and dealers in electrical radio or other goods, &c. The directors are:—J. M. Hawkins, "Waverley," Thorpewood Avenue, Sydenham Hill, S.E.26, electrical engineer; E. C. G. Hawkins, 2, Overhill Road, S.E.22, secretary. Secretary: E. C. G. Hawkins. Registered office: 26, Cheapside, E.C.2.

Telephone Manufacturing Co. (1929), Ltd.—Registered as a public company December 3rd. Capital, £250,000 in 5s. shares. Objects: To acquire the business carried on by the Telephone Manufacturing Co., Ltd. (other than shares in the subsidiary companies referred to in an agreement between the said company and F. C. T. Lane, the liquidator thereof of the first part, Telephone Rentals, Ltd., of the second part, and this company of the third part, and the consideration for such shares to be received by such company), and to carry on the business of makers, sellers, hirers-out, buyers, installers, maintainers, and workers of private or other telephones and telegraphs, makers and sellers of electrical apparatus of all kinds, &c. The subscribers (each with one share) are:—C. P. Heseltine, Pinewood, Chislehurst, stockbroker; H. W. Morrison, Lavant House, Roehampton; J. MacMahon, Sheriff Park House, Rutherglen, director of Telephone Manufacturing Co., Ltd.; C. Cochran, 34, Dalziel Drive, Glasgow, director of Telephone Manufacturing Co., Ltd.; W. Campbell, Picket Wood, Merstham, director of Telephone Manufacturing Co., Ltd.; C. Reid, 1, Leadenhall Street, E.C.3; F. T. Jackson, 20, Herne Hill, S.E.24, director of Telephone Manufacturing Co., Ltd. The first directors are to be appointed by the subscribers. Registered office: Hollingsworth Works, Martell Road, West Dulwich, S.E.21.

Telephone Rentals, Ltd.—Registered as a public company December 3rd. Capital, £600,000 in 5s. shares. Objects: To acquire from the Telephone Manufacturing Co., Ltd., that part of its undertaking which consists of the issued share capital of those of its subsidiary companies mentioned in an agreement between the above-mentioned company and F. C. T. Lane, the liquidator thereof of the first part, the company of the second part, and the Telephone Manufacturing Co. (1929), Ltd., of the third part, to acquire and hold shares, stocks, debentures, &c., to carry on the business of making, selling, hiring-out, buying, installing, maintaining, and working private or other telephones and telegraphs, makers and sellers of electrical apparatus, &c. The subscribers are similar to those in the case of the Telephone Manufacturing Co. (1929), Ltd. Registered office: Hollingsworth Works, Martell Road, West Dulwich, S.E.21.

J. N. Boyes, Ltd.—Private company. Registered December 4th. Capital, £500 in £1 shares. Objects: To acquire the business of electrical engineering and motor repairing carried on by J. N. Boyes, at 10, William Street, London, and to carry on the business of mechanical, electrical, wireless and general engineers, manufacturers and repairers of and dealers in motor cars, &c. The directors are: D. Harris and C. B. Benson, addresses not stated. Registered office: 10, Serjeants' Inn, Temple, E.C.4.

Frederick Squire, Ltd.—Private company. Registered December 2nd. Capital £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in radio apparatus, loud-speakers, apparatus for the transmission and reception of pictures by wireless, scientific and optical instruments, gramophones and records, amplifiers, generators, accumulators and batteries, mechanical and electrical engineers, manufacturers of and dealers in motor cars, cycles, &c. The first directors are: F. Squire, engineer, and Emily Squire, 64, Linthorpe Road, Stamford Hill, N.16 (both permanent). Registered office: King's Works, Leswin Place, Stoke Newington, N.16.

Dunoon & District Electricity Supply Co., Ltd.—Registered as a public company December 2nd. Capital, £20,000 in £1 shares. Objects: To take over and put into operation the Dunoon Electricity Special Order, 1929, and to carry on the business of an electric light and power supply company in all its branches. The subscribers (each with one share) are: G. H. Webber, 179, Abbey Wood Road, S.E.2, clerk; S. A. Pierpoint, 7, Muschamp Road, S.E.15, clerk; and five others. The first directors are to be appointed by the subscribers. The board shall not, without the sanction of a general meeting, so borrow or raise any money, other than temporary loans from bankers or others, in the ordinary course of the company's business, as to make the amount borrowed and then outstanding exceed £75,000. Solicitors: J. D. Langton & Passmore, 71, Powis Street, Woolwich, S.E.18.

Electric Service Co. (Birmingham), Ltd.—Private company. Registered December 2nd. Capital, £2,500 in £1 shares. Objects: To carry on the business of electric service and accumulator specialists formerly carried on by P. H. Jones and Nancy Jones, at 125, Bristol Street, Birmingham. The first directors are: P. H. Jones, 14, Vicarage Road, Edgbaston, Birmingham, engineer; W. E. Tollworthy, 26, Rotton Park Road, Edgbaston, manager; Nancy Jones and W. Tollworthy, addresses not stated. Qualification: £250. Secretary: Nancy Jones. Registered office: 125, Bristol Street, Birmingham.

Electrical Reproducers, Ltd.—Private company. Registered in Edinburgh on November 27th. Capital, £100 in £1 shares. Objects: To carry on the business of electrical, radio, mechanical, motor, marine, consulting and mining engineers, &c. The directors are: W. L. Greenwood, Bankhead Cottage, Carmunnock, Glasgow; S. J. Smith, 39, Randolph Road, Broomnill, Glasgow, electrical engineers. Registered office: 102, West Regent Street, Glasgow, C.2.

English Alabaster Marble & Lighting Co., Ltd.—Private company. Registered December 2nd. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in alabaster bowls, vases, table stands, and brackets, &c., electrical and wireless engineers and experts, designers and manufacturers of and dealers in lamps, globes, brackets, &c. The directors are: H. H. D. Duncan (chairman), 144, Boleyn Road, Forest Gate, E.7; G. H. Covington, Langham House, Queensberry Road, Kettering. Qualification: £100 shares.

Vulcanized Fibre Marketing Board, Ltd.—Private company. Registered December 5th. Capital, £1.000 in £1 shares. Objects: To promote the marketing of vulcanised fibre and

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insulating materials, &c. The permanent directors are: F. N. MacEchern (chairman), "Merven," Christchurch Avenue, Finchley, N.12, vulcanised fibre manufacturer; A. M. Livingstone, 2, St. Albans Road, N.W.5, paper manufacturer. Secretary: J. F. Hudson, Dacre House, 5, Arundel Street, W.C.2.

Air-Way, Ltd.—Private company. Registered December 6th. Capital, £20,000 in 13,000 "A" and 7,000 "B" shares of £1 each. Objects:—To carry on the business of manufacturers of, and dealers in electrical and sanitary apparatus, appliances, parts and accessories of all kinds, &c. The directors are:—A. J. M. Duncan, 95, Barkston Gardens, S.W.3; J. H. Bulloch, 98, Clifton Court, St. John's Wood, N.W.8; J. I. Pickering, 11a, Hogarth Road, Earl's Court, S.W.3; M. C. Dizer, "Westfield," West Heath Road, Hampstead, N.W.; H. A. Pridham, 61, Curzon Street, W.1 (sales manager, Kolster-Brandes, Ltd.). Registered office: 15-19, Cavendish Place, W.

Official Returns of Electrical Companies.

Lancashire Ignition Co., Ltd.—Capital, £1,500 in £1 shares. Return dated July 26th, 1929. Two shares taken up. £2 paid. Mortgages and charges, nil.

Richardsons, Westgarth & Co., Ltd.—Capital, £700,000 in 350,000 preference and 350,000 ordinary shares of £1 each. Return dated May 24th (filed June 12th), 1929. All shares taken up. £700,000 paid. Mortgages and charges: £25,605.

Vaughan Crane Co., Ltd.—Capital, £150,000 in 50,000 preference and 100,000 ordinary shares of £1 each. Return dated September 25th, 1929. 16,880 preference and 53,578 ordinary shares taken up. £43,669 paid. £26,789 considered as paid. Mortgages and charges, nil.

W. J. Henderson & Co., Ltd.—Mortgage debenture dated November 12th, 1929, to secure £2,000, charged on the company's property, present and future, including uncalled capital. Holder:—A. F. Phelp, 54, Queen's Road, Brighton.

Runbaken Motor and Electrical Accessories, Ltd.—Particulars filed of £5,000 debentures authorised November 14th, 1929, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

G. & L. Electrical Supply Co., Ltd.—Particulars filed of £2,000 debentures authorised October 29th, 1929, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Electrical Agencies (London), Ltd.—Particulars filed of £800 debentures authorised October 29th, 1929, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Falconar, Cross & Co., Ltd.—Capital, £7,000 in 3,500 preference and 3,500 ordinary shares of £1 each. Return dated July 26th, 1929. 3,300 preference and 2,002 ordinary shares taken up. £2 paid. £5,500 considered as paid. Mortgages and charges, nil.

Metropolitan-Vickers Electrical Co., Ltd.—Capital, £250,000 in £1 shares. Return dated August 1st, 1929. 10,002 shares taken up. £10,002 paid. Mortgages and charges, nil.

Metropolitan-Vickers Electrical Co. (Mediterranean), Ltd.—Capital, £1,000 in £1 shares. Return dated August 26th, 1929. All shares taken up. £1,000 paid. Mortgages and charges, nil.

Upfields Wireless, Ltd.—Mortgage dated November 18th, 1929, to secure £1,000, charged on 5, Hughenden Place, Hastings. Holders: Hastings Permanent Building Society, 17, Havelock Road, Hastings.

Fellows Manufacturing Co., Ltd.—Particulars filed of £36,000 second debentures and premium of 7½ per cent. authorised July 11th, 1929, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £15,200 (on November 15th, 1929).

P. A. Bristow, 68½, Upper Thames Street E.C.4, was appointed receiver and manager on November 29th, 1929, under powers contained in debentures dated September 27th, 1927.

Calcutta Tramways Co., Ltd.—Capital, £1,400,000 in 700,000 preference and 700,000 ordinary shares of £1 each. Return dated June 27th, 1929. 250,000 preference and 700,000 ordinary shares taken up. £764,900 paid (being £1 per share on 250,000 preference and 409,100 ordinary, 8s. per share on 22,000 ordinary, 10s. per share on 40,000 ordinary, and 14s. per share on 110,000 ordinary shares). £185,100 considered as paid (being £1 per share on 118,900 ordinary, 12s. per share on 22,000 ordinary, 10s. per share on 40,000 ordinary, and 6s. per share on 110,000 ordinary shares). Mortgages and charges: £350,000 4½ per cent. first debenture stock, and £233,600 7 per cent. second (registered) debentures.

Henley's (South Africa) Telegraph Works Co., Ltd.—Capital, £2,000 in £1 shares. Return dated July 19th, 1929. All shares taken up. £2,000 paid. Mortgages and charges, nil.

British Battery Co., Ltd.—Debenture dated November 28th, 1929, to secure £300, charged on the company's undertaking and property, present and future, including uncalled capital. Holder:—E. H. E. Morley, The Homestead, Sydney Road, Watford.

Herne Bay & District Electricity Supply Co., Ltd.—Particulars filed of £30,000 debentures authorised November 26th, 1929, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £20,000.

Smethurst & Co. (London), Ltd.—Deed of covenant dated November 27th, 1929, to secure £500, charged on 72, Duke Street, Grosvenor Square, W. Holder: Miss S. P. Findlater, c/o Barclays Bank, Ltd., 208, Regent Street, W.1.

Charing Cross Electricity Supply Co., Ltd.—Satisfaction in full (1) on April 1st, 1926, of £250,000 secured notes, secured by trust deed dated April 12th, and registered April 28th, 1920, and (2) on January 15th, 1909, of debentures authorised May 31st, 1901, and registered on various dates between August 8th, 1901, and February 8th, 1906, securing £472,000. (Notices filed November 27th, 1929.)

Keighley Electrical Engineering Co., Ltd.—Satisfaction to the extent of £500 on November 20th, 1929, of second debenture dated March 16th, and registered March 21st, 1928.

Charles Warren, Ltd.—Capital, £6,000 in £1 shares. Return dated May 30th (filed July 19th), 1929. 5,700 shares taken up. £1,500 paid. £4,200 considered as paid. Mortgages and charges, nil.

Whitehall Electric Investments, Ltd.—Capital, £7,500,000 in 2,500,000 preference and 5,000,000 ordinary shares of £1 each. Return dated July 4th, 1929. All shares taken up. £2,500,007 paid on 2,500,000 preference and 7 ordinary shares. £4,999,993 considered as paid on 4,999,993 ordinary shares. Mortgages and charges: £3,191,548.

Premier Accumulator Co. (1921), Ltd.—Capital, £40,000 in £1 shares. Return dated June 26th, 1929. All shares taken up. £18,749 paid (being £1 per share on 11,249 and 15s. per share on 10,000 shares). £18,751 considered as paid on 18,751 shares. Mortgages and charges, nil.

Sphere Investment Trust, Ltd. (formerly United Electric Tramways of Montevideo, Ltd.).—Capital, £1,000,000 in 500,000 preference and 500,000 ordinary shares of £1 each. Return dated June 25th, 1929. All shares taken up. £295,105 paid on 131,105 preference and 164,000 ordinary shares £704,895 considered as paid on 368,895 preference and 336,000 ordinary shares. Mortgages and charges, nil.

Langham Radio, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated November 14th, 1929, to secure all moneys due or to become due from the company to Lloyds Bank, Ltd.

City Notes.

Venezuela Telephone and Electrical Appliances Co., Ltd.

The directors' report for the year ended June 30th last records a profit of £53,995, as compared with £48,843 in 1927-28. After meeting debenture interest, &c., there is a balance of £38,387, to which is added £47,832 brought forward, making £86,219. The ordinary dividend is maintained at 8 per cent.; £8,766 is written off issue expenses; £1,500 is transferred to the 6 per cent. first mortgage debenture sinking fund; and £30,000 is placed to renewals and depreciation reserve, leaving £31,128 to be carried forward. There was a satisfactory rise in telephone service receipts—from £115,988 to £131,356. Automatic equipment for a further 2,000 lines (making 8,000 lines) is being installed in Caracas. In June last the capital was increased to £600,000 by the creation of 320,000 "A" ordinary shares of £1 each, of which 136,975 were offered to and taken up by shareholders on a *pro rata* basis at par. At the annual meeting on December 17th resolutions will be put forward increasing the directors' borrowing powers from £100,000 to £200,000 and increasing their remuneration owing to an addition to their number.

Stock Exchange Notices.

Application has been made to the Committee to allow the following to be quoted officially:—

Aldershot Gas, Water, and District Lighting Company.—£110,000 4 per cent. consolidated preference stock.

Bristol Tramways and Carriage Company.—1,000,000 ordinary shares of £1 each, fully paid, Nos. 1 to 1,000,000; and 500,000 preference shares of £1 each, fully paid, Nos. 1 to 500,000.

Dealings in the following have been allowed by the Committee under Rule 159:—

Avery (W. and T.), Ltd.—676,458 ordinary shares of £1 each fully paid, Nos. 1 to 676,458. 26,846 5 per cent. cumulative

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"A" preference shares of £5 each fully paid, Nos. 1 to 26,846. 147,128 5½ per cent. cumulative "B" preference shares of £1 each fully paid, Nos. 1 to 147,128.

Underground Electric Railways Co. of London, Ltd.—951 ordinary shares of £1 each fully paid, Nos. 7,277,322 to 7,278,272.

S. Smith & Sons (Motor Accessories), Ltd.

Presiding at the annual meeting last week, Mr. W. Henderson-Cleland (chairman) said that the main products of the company and its subsidiaries were now fitted as standard to over 95 per cent. of the British-made motor cars and commercial vehicles, while their magnetos, sparking plugs, &c., were fitted to a lesser degree. Its subsidiary, the M-L Magneto Syndicate, Ltd., had had a satisfactory year, and success for its products had been obtained in the Tourist Trophy races. The report and accounts were adopted.

American General Electric.

It was announced this week that this company proposes to divide its common shares into four shares of no par value and to place the new shares on a $1.60 annual dividend basis; the current corresponding dividend is $1.50.

The usual quarterly dividend of $1.50 has been declared on the common shares, together with one of $0.15 on the special stock.

Ebonite Container Co., Ltd.

At an extraordinary meeting on December 4th a resolution was passed raising the capital to £100,000 by the creation of 200,000 ordinary shares of 4s. each. The new capital will be employed in the acquisition of a controlling interest in another company.

Callender's Share and Investment Trust, Ltd.

The revenue to August 31st was £45,598, and the net profit £37,219, of which £500 is placed to reserve, and £3,000 to special reserve. A dividend of 20 per cent., less tax (as against 15 per cent.) is proposed, and £36,364 is carried forward.

County of London Electric Supply Co., Ltd.

The directors have decided to make an issue of £1 ordinary shares. These will be offered to the present ordinary shareholders in the proportion of one new share for each three held.

Beauharnois Power Corporation.

This company has made an issue of $30,000,000 of 30-year 6 per cent. bonds for the purpose of raising capital for the construction of a 500,000-h.p. hydro-electric scheme on the St. Lawrence River.

Yarrow & Co., Ltd.

The profit for the year ended June 30th last, after deducting debenture interest and depreciation, is £3,320, to which is added £4,154, making £7,474, which the directors recommend should be carried forward.

English Electric Co., Ltd.

We are officially informed that the statements regarding the reconstruction of the company's capital which have appeared in the daily Press are unauthorised and untrue.

Postal Telegraph and Cable Corporation.

The directors have declared a quarterly dividend of 1¾ per cent. on the 7 per cent. non-cumulative preferred stock, payable January 2nd to stockholders of record December 13th.

Petters, Ltd.

An interim dividend on the 7½ per cent. cumulative preference shares has been declared in respect of the half-year ended September 30th, less tax at 4s.

Great Northern Telegraph Co., Ltd.

An interim dividend of 5 per cent. per annum, less tax, for the half year, payable on January 1st, has been declared.

Barcelona Traction, Light and Power Co., Ltd.

The directors have declared a quarterly dividend of 1¾ per cent. in respect of the fixed dividend of 7 per cent. per annum on the non-cumulative participating preference shares.

Murex, Ltd.

This company announces the acquisition of about 92 per cent. of the issued capital of the Premier Electric Welding Co., Ltd., from Imperial Chemical Industries, Ltd.

Shawinigan Water and Power Co.

A dividend of $0.625 per share has been declared on the common shares for the quarter ending December 31st.

Pennsylvania Water and Power Co.

The quarterly dividend on the common shares has been raised from $⅝ to $¾ for the quarter ending December 31st.

Stocks and Shares.

TUESDAY EVENING.

THE Stock Exchange has entered upon the last account of the year, and, from Monday next week, dealings will start for payment on January 9th, 1930. It is possible that business in stocks and shares is restrained for the moment by the dislike that most people have to parting from money on the eve of the New Year, for window-dressing continues to exercise a hold upon the mind of the ordinary person, and he likes to make as fair a show as he can in his pass book at the end of December. There are, however, favourable factors which have come into play just recently, one of them being a substantial recovery in American stocks and shares, including those of the utility companies, while at home there is a weekly prospect of the Bank Rate being reduced to 5 per cent. Against these influences has to be set the continued anxiety respecting the outcome of the settlement in Hatry stock and shares, no date for the settlement having yet been fixed by the Stock Exchange Committee. Business is quiet, but there is a general disposition to regard the outlook for 1930 as being one in which the development of electricity for power, domestic, and other purposes is likely to stand out as being amongst the principal features.

London's Tubes and Trams.

The Government has been bombarded with questions as to what it really means in announcing its intentions with regard to London traffic. To what extent the stockholders themselves will be affected is a matter still in doubt. Various vague statements have been made, which profess to illuminate the Government's policy, but none of these touch the principal question as to what is going to be done in the way of dealing with the issues of the various companies concerned in the arrangement. So long as this twilight of uncertainty remains, the various stocks and shares can hardly fail to be dull in price, but the fall of 4 points in Underground income bonds served to bring in a few purchasers, and the price rallied a trifle after its drop. Metropolitan consolidated put on a point, by reason of dividend hopes. The other stocks in the group have scarcely changed, while the position of the market in the various tramway shares is much the same as that of a week ago; namely, that although prices are quoted, these are mainly nominal, and either buyer or seller may find it difficult to deal, except by way of negotiation. London and Suburban Traction preference are marked up 6d. to 10s.

There is on offer a few thousand pounds of London Electric Railway ordinary stock, at 70¾. Last year's dividend was 5 per cent. On this basis, the yield on the money comes to £7 2s. 6d. per cent.

Home Electricity Shares.

In the list of prices of shares in Home Electricity companies given here, only one change has occurred on the week. This is so unusual as to be noteworthy, and it indicates the condition of business quietude that prevails in a good many of the investment markets round the Stock Exchange. County of London Electric Supply ordinary shares are 1s. down at 47s. The company announces a reduction of charges in its areas within the administrative County of London, and the South Metropolitan Electric Light & Power Company is also lowering its charges. The Grampian Electricity Company's scheme for generation by water power, as a feeder to the national grid, was thrown out by the House of Lords Select Committee. Of the shares which are not quoted in our own lists, Northamptons are unchanged at 44s. 6d., having remained without alteration for a fortnight. Egham & Staines ordinary have fallen 1s. to 34s., and the new are called easier at 33s. British Light & Power are steady at 13s. 9d., Atlas at 27s. 6d. Isle of Thanet, at 32s., are 1s. better, the preference being 23s. Of the new issues, Metropolitans are firm at 5s. 6d. premium, and Midland Counties new improved to 1s. 3d. premium. Scottish Electric new shares eased off to 27s. 6d., which is 1s. 6d. less than the price of the senior issue. Lancashire Electric 7 per cent. preference show a slight decline at 27s. Whitehall Electric 6 per cent. debenture is up 1½ points, at 102.

Telegraphs and Telephones.

Further falls have occurred in the prices of Cables & Wireless stocks. The "A" ordinary shed 3, going back to 76½, and the "B" ordinary stock, at 37½, is similarly lower. Both have been still easier during the week. In explanation of the flatness of the "B" stock, a report gained ground to the effect that the first year's working of the Merger is likely to show that the prospect of a dividend on the junior issue is nebulous for the next few years. It has already been mentioned here that the dividend on the "A" stock for the first twelve months' working is thought by some people to be unlikely to exceed 4 per cent., against the 7½ per cent. to which the stock is entitled, and that it will be a couple of years before the latter rate is likely to be paid. Following this line of argument, it is contended that the "B" stock cannot expect to come in for any distribution, at all events until three years have passed, and that, for the next twelve months or so, the stock can hardly be regarded as anything better than

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either a gambling counter, or a lock-up, representative of the equity of a business which, if it flourishes in accordance with anticipation, should one of these days be of substantial value. There is a good deal of difference between the present price of 37½ and the 72 at which the stock was first negotiated early in July this year—to say nothing of the 104 to which it rose within the course of a very few days. Regarded as a rich man's gamble, the stock is probably worth putting away at anything like the current quotation.

Marconis and Telephones.

Marconi Marine Wireless shares are ⅛ up at 2 7/16, the shares having now recovered from the dulness which overtook them upon the reduction in the last-announced interim dividend. According to report, the company is doing exceedingly well, though the optimists do not go so far as to commit themselves to the prophecy that the dividend for the full year will be equal to the 15 per cent. paid in respect of the previous period. Anglo-American Telegraph preferred stock has strengthened to 100½. Venezuela Telephone ordinary advanced to 25s. 6d., the preference also being better at 26s. 3d., on the issue of an annual report which, once more, shows very consistent progress. At the forthcoming meeting next Tuesday, the directors will take power to increase the capital and their own remuneration. The "A" shares, which were issued last June at par, stand at 20s. They carry no voting rights, and rank for dividend as from July 1st this year. There seems to be undue discrepancy between the prices of these "A" shares and those of the company's ordinary and preference. The last two are to receive 8 per cent. for the year. Anglo-Portuguese Telephones recedd to 20s. 6d.

Dollar Stocks.

Brazilian Tractions, at 46, show a gain of 4 points, and stand out as one of the very few shares in which there is lively interest taken by the public in Stock Exchange markets. The buying started from New York and Montreal, where previously heavy liquidation had reduced the price of the shares below 40. There is talk of the company increasing its dividend, as we mentioned here last week, and this has imparted a better tendency, not only to the common shares, but also to the preference, which have gained 10 points at 150. Montreal Light & Power shares, at 136½, are 16 points up, Shawinigan, at 82½, 4 points. Pennsylvania Power hardened to 78½; the company has raised its dividend, from ½ per quarter, to ⅝ per quarter. American Telephone & Telegraph, at 235, shows a gain of 7. International Telephone & Telegraphs, at 85, are 12 points higher. Hydro-Electrics, which were 34 a week or two ago, are nearly 42. The Mexican group, however, remains heavy. There is a fall of a couple of points in Mexican Light and Power first bonds to 73½. Sao Paulo Electric firsts, at 83½, are lower. Electrical Development of Ontario firsts strengthened to 97½. It is a little ironical to read that progress in Vancouver has been threatened by a spell of unprecedented dry weather. This is said to have created a serious situation for the city's industries, by reason of the fear of a shortage of power, and the Municipality met to consider the advisability of rationing the supply. The Montreal Light & Power Company, and the Ontario Hydro-Electric Power Commission, are concerned in the plan of the new hydro-electric power programme, put forward by the Beauharnois Power Corporation. The potential development is two million horse power, and the project is described as being one of the largest power enterprises in the world. A bond issue is being made for the purpose of financing construction, and work on a plant of 500,000 h.p. on the St. Lawrence River has already been started.

The Manufacturing Group.

Various reports have been current during the past week to the effect that the English Electric Company proposes to reorganise its capital, but these have been contradicted, although it may not be very difficult to guess the reason for the rumours having come into circulation. The ordinary shares are unchanged at 6s. 3d.; the preference, at 7s. 6d., are 1s. 3d. down. Crompton Parkinson ordinary can be bought at 20s., or a little less. Edison Swan ordinary last changed hands at 13s. 6d., this being about a month ago. Associated Electrical Industries ordinary, at 25s. 9d., have lost 3s. G.E.C. ordinary continue to advance, and at 2⅜ are 1/16 better. The 7½ per cent. "B" preference drooped to 25s. Callenders retain their rise at 3¾, and the group as a whole shows firmness. There has been little evidence of liquidation in this section. People who study the trend of share values will have observed that the market for electrical manufacturing companies' shares has been one of the very few which, through the recent crisis, kept up its end with almost unimpaired strength. Anticipations have been raised in connection with a possible issue of bonus shares next year by one of the big manufacturing concerns, but nothing definite has yet transpired. Ever-Ready shares touched 20s. before reacting to 19s. Telephone Manufacturing shares are unchanged at 4s. 3d. The company has now been split into the Telephone Manufacturing Co. (1929), Ltd., and Telephone Rentals, Ltd.

The market for iron and steel shares has been a little better, with Vickers hardening to 8s. Babcock & Wilcox remain at 62s. Rubber shares are finishing the year in a condition of somnolence, not to say stupor.

Share List of Electrical Companies.

	Nom. £	Approx. Dividend. 1927.	1928.	Price Dec. 10 1929.	Rise or fall	Yield p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	58/9	—	5 2 0
Brompton Ordinary	1	8⅜	8½	25/6	-6d.	5 9 10
Charing Cross Ordinary	1	8¼	8¼	26/6	—	5 5 8
do. do. 4½% Pref.	1	4½	4½	17/-	—	5 6 0
Chelsea	1	8¼	8⅛	25/-	—	5 12 0
City of London	1	10	10	32/-	—	4 7 6
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	1½⅜	—	... ...
County of London	1	7	10	47/-	—1/-	4 5 1
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Edmundson's 7% Pref.	1	7	7	24/-	—	5 16 8
Elec. Supply Corporation	1	11	11	48/3	—	4 11 3
Kensington Ordinary	1	8	8	26/-	—	5 7 8
Lancs. Light and Power	1	7½	7½	27/-	—	5 11 2
London Electric	1	8½	9	27/-	—	5 1 10
Metropolitan	1	9	9	37/6	—	4 16 0
do. 4½% Pref.	1	4½	4½	17/-	—	5 6 0
Midland Counties	1	6½	6½	28/-	—	4 12 10
Mid. Elec. Power	1	15	8	33/9	—	4 14 10
Newcastle-on-Tyne Ordinary	1	6	6	23/9	—	5 1 1
do. 7% Pref.	1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	10	6	6	11	—	5 9 1
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	1	8	8	26/-	—	5 7 8
Scottish Power	1	8	8	29/-	—	5 13 3
South London	1	8½	8½	25/6	—	5 9 10
Urban Ordinary	1	7	7	35/-	—	4 0 0
Westminster Ordinary	1	8½	8½	25/-	—	5 12 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	23/6	—	6 7 8
Yorkshire Elec.	1	8	8	33/9	—	4 14 10
HOME RAILS.						
Central London Ord. Assented	Stock	4	4	71	—	5 12 8
Metropolitan	,,	8	8½	62½	+1	5 12 0
do. District	,,	4	5	72	—	6 19 0
Underground Electric	£1	5	7	21/6	—	6 10 8
do. do. Income	Bonds	6	6	103	—	5 16 6
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	100½	+1	5 19 6
do. Def.	,,	1½	1½	24½	—	6 4 6
Automatic Telephone	1	19	12½	37/6	—	6 13 4
Cables & Wireless 5% Pref.	Stock	—	—	96	—	5 14 ...
do. A 7½ Ord.	,,	—	—	76½	—3	... ...
do. B Ord.	,,	—	—	37½	—3	... ...
Globe Tel. and T. Ord.	10	10	10	23	—	*4 7 0
do. do. Pref.	10	6	6	10⅞	—	5 9 1
Great Northern Tel.	10	20	17½	29	—	6 0 9
Indo-European	25	10	10	52½	—	*8 16 2
Marconi-Marine	1	12½	15	2 7/16	+⅛	... ...
Oriental Telephone Ord	1	12	12	2 1/16	—	... ...
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	8⅜	—	8 16 0
do. do. 2nd Pref.	5	6	6	3⅜	+1/16	9 12 0
do. do. 5% Deb.	Stock	5	5	72½	—	6 18 0
British Electric Traction Def. Ord.	,,	5	5	1525	+100	... ...
do. do. Pref. Ord.	,,	8	8	120	—	6 13 4
Brazil Traction	100	7	8	46	+4	4 7 6
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	87½	—	5 14 3
London & Sub. Trac. 5% Pref.	1	Nil	Nil	10/-	+6d.	... ...
London United Tram Deb.	Stock	4	4	51½	—	7 15 4
Mexico Trams, 5% Bonds	—	5	5	72½	—	6 18 0
Mexican Light Common	100	Nil	Nil	75	—	... ...
do. 7% Pref.	100	7	7	77½	—	9 0 8
do. 1st Bonds	—	5	5	73½	—2	6 16 1
Yorkshire (West Riding)		Nil	Nil	5/-	—	... ...
MANUFACTURING COMPANIES.						
Assoc. Elec. Ord.	1	6	—	25/9	—3/-	4 18 2
Babcock & Wilcox	1	18	15	62/-	—	*4 16 9
British Aluminium Ord.	1	10	10	46/-	—	*4 7 0
British Elec. Transformer Pref.	1	7	7	18/-	—	... ...
British Insulated Ord.	1	15	15	3⅜	—	4 0 0
Brush Ord.	Stock	10	10	126½	—	7 18 1
Callenders	1	15	15	3¾	—	4 0 0
do. 6½% Pref.	1	6½	6½	1⅞	—	5 4 0
Crompton Parkinson Ord.	5/-	—	30	20/-	—	7 10 0
do. 8% Pref.	1	8	8	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	7 1 2
do. 5% Deb.	Stock	5	5	84½	—	5 18 4
Electric Construction	1	7½	5½	15/-	—	7 6 8
Enfield Cable Ord.	1	20	20	4⅜	—	4 2 0
English Electric	1	Nil	Nil	6/3	—	... ...
do. do. Pref.	1	8	Nil	7/6	—1/16	... ...
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
do. Ord.	1	10	10	2⅜	+1/16	4 4 3
Henley	1	25	30	5⅛	—	5 2 0
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	Nil	Nil	11/3	—	... ...
Johnson & Phillips	1	10	—	36/3	—	5 10 3
Siemens Ord.	1	7½	7½	26/3	—	5 14 3
Telegraph Construction	12	10	10	28	—	5 4 2
Victoria Falls Ord.	1	15	15	2⅝	—	5 4 2

* Dividends paid free of Income Tax.

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Electrical Imports of Spain.

Statistics for 1927 and 1928 Compared.

THE following figures, showing the imports of electrical goods into Spain in 1928 are taken from the recently issued trade statistics. The totals for 1927 are given for purposes of comparison, and notes of increases or decreases added. All the important classes of goods, with the exception of wires and cables, show increases, some of them, *e.g.*, dynamos, transformers, &c., and electrical fittings, of quite a substantial character. In the former group the advance in the share of the United States has been marked, as also has that of Switzerland. Generally Great Britain does not make a very good showing; in fact her trade is scarcely maintained at the level of 1927.

Of interest in connection with the future market for power plant in Spain is the formation at the instance of the Ministry of Public Works of a Council of Power, which is to include representatives of the Government, railways, power and fuel companies, electrochemical industries and consumers generally. Its object is to draft plans for the production of power for public service and industries at the cheapest possible rates. The Council has to form a syndicate and arrange for a "grid" system for the use of the railways and chemical industries. The initial price of electricity is to be 0.6 peseta and the ultimate price, if possible, 0.1 peseta

	1927. Quantities. 100 kg.	1928. Quantities. 100 kg.	Inc. or dec.
Dynamos, motors, transformers, switchgear, &c.—			
Total	48,550	69,670	+21,120
From Germany	11,110	13,510	+ 2,400
,, United States	3,310	11,950	+ 8,640
,, France	13,023	9,630	- 3,393
,, Great Britain	5,040	5,440	+ 400
,, Sweden	3,180	3,480	+ 300
,, Belgium	830	870	+ 40
,, Switzerland	9,220	21,650	+12,430
,, Italy	730	570	- 160
,, Holland	1,524	1,000	- 524
Self-contained generating sets—			
Total	5,676	6,900	+ 1,224
From Germany	780	700	- 80
,, France	2,440	3,910	+ 1,470
,, Great Britain	1,350	350	- 1,000
,, United States	270	440	+ 170
,, Switzerland	650	1,132	+ 482
Switchboards—			
Total	839	1,670	+ 831
From Germany	181	280	+ 99
,, United States	22	245	+ 223
,, France	225	610	+ 385
,, Great Britain	108	150	+ 42
Electrical fittings (switches, lampholders, &c.)—			
Total	7,710	19,010	+11,300
From United States	980	2,730	+ 1,750
,, Germany	1,850	2,890	+ 1,040
,, Great Britain	480	2,170	+ 1,690
,, Belgium	600	3,500	+ 2,900
Electrical measuring instruments and parts thereof—			
Total	1,760	1,810	+ 50
From Germany	900	830	- 70
,, France	190	186	- 4
,, Switzerland	497	696	+ 199
,, Great Britain	22	26	+ 4
Stoves, heaters, cookers, irons, &c.—			
Total	680	1,160	+ 480
From Germany	160	410	+ 250
,, Switzerland	350	550	+ 200
Accumulators, dry batteries, and parts—			
Total	6,870	7,930	+ 1,060
From Denmark	1,040	1,330	+ 290
,, Germany	1,360	1,860	+ 500
,, Great Britain	640	640	—
,, United States	2,197	1,510	- 687
,, France	1,160	2,460	+ 1,300
,, Sweden	130	130	—
Wires and cables—			
Total	32,360	14,980	-17,380
From Great Britain	17,820	3,420	-14,400
,, Germany	3,390	3,670	+ 280
,, France	8,840	3,110	- 5,730
,, United States	250	905	+ 655
Incandescent electric lamps—			
Total	1,270	1,620	+ 350
From Holland	710	483	- 227
,, Great Britain	10	7	- 3
,, France	150	246	+ 96
Telegraph and telephone switchboards and apparatus—			
Total	5,820	3,120	- 2,700
From France	317	320	+ 3
,, Belgium	4,568	1,324	- 3,244
,, Germany	284	210	- 74
,, Great Britain	162	450	+ 288
,, United States	360	600	+ 240
,, Sweden	340	230	- 110
Wireless valves—			
Total	17	15	- 2
From Germany	5	5	- 5
,, United States	7	5	- 2
,, France	4	1	- 3
,, Holland	—	8	+ 8
Electric mercury vapour lamps, searchlights, &c.—			
Total	80	166	+ 86
From United States	5	—	- 5
,, France	4	3	- 1
,, Germany	57	156	+ 99
Carbons, other electrodes, &c.—			
Total	5,530	6,400	+ 870
From United States	3,190	2,915	- 175
,, Great Britain	754	510	- 244
,, Germany	230	1,063	+ 833
,, France	1,150	1,380	+ 230
Insulating tapes, fabrics, and tubes—			
Total	12,970	3,850	- 9,120
From United States	11,670	3,150	- 8,520
,, Germany	1,055	490	- 565
,, Great Britain	40	10	- 30

Domestic Appliances in Holland.

Opportunities for British Makers.

THE Canadian Trade Commissioner at Rotterdam calls attention to the efforts which are being made in Holland to popularise the use of household electrical appliances. Judging by what he says on this subject, the British exporter of such goods should not find great difficulty in increasing his sales. One obstacle to the widespread use of domestic apparatus is the absence of standardised voltage, a handicap with which he is familiar in his own home market. It is clear that a vigorous advertising campaign is necessary, and it would appear from the results of the Canadian Trade Commissioner's investigations that the campaign should be largely directed towards convincing the prospective consumer that household electrical appliances are not expensive from the point of view of the amount of energy necessary for their operation. Connected with this side of the question is the fact that domestic help is plentiful and cheap in the rural districts, although becoming dearer in the towns and cities. The Trade Commissioner proceeds to examine in detail the state of the market for various domestic electrical devices. A summary of his remarks follows:—

Vacuum cleaners are the most extensively used of any of the appliances on sale. They are welcomed in the homes of the middle and upper classes, but the field of sale seems to be fairly well covered, as there are about 25 different makes on the market. The prices vary from £17 10s. to £7, some German makes being among the cheaper models. They can be bought on the hire-purchase system. Of electric heaters Dutch manufacturers control the larger part of the sale. They are all of the reflector type, and throw heat only in one direction. The sale of electric washing machines has made some progress during the last three years, but they are still looked upon as novelties, if not as curiosities. There are no laundry rooms in the basements of houses where washing can be done, and in the newer type of dwellings the kitchens are too small to be used for the purpose. Most Dutch housewives, therefore, send their washing out to laundries. A European model of the "dolly" pattern, with a motor placed beneath a wooden tub, is sold as cheaply as £10. An American refrigerator has been widely advertised in Holland in the past year or two, but it is reported that the results have been somewhat disappointing. In addition, there are two European makes on the market selling at from £40 to £95. Prospects do not seem very promising for this article, as ice is cheap and plentiful in Holland, and perishable food easy to obtain. Electric irons are commonly used in Holland, most of them coming from Germany, but stoves and ranges are practically unknown. For cooking the use of electricity is hampered by the cheapness of gas and gas stoves.

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New Electrical Schemes before Parliament.

A Brief Summary of Notices which have appeared in the *London Gazette*.

WE publish below a list of proposals of an electrical nature that will come forward in the 1929-30 session of Parliament. Readers who are desirous of obtaining further information will find the notices published in the *London Gazette* for November 22nd and 26th.

(a) Electric Light and Power.

Shropshire, Worcestershire and Staffordshire Electric Power Co.—Additional financial powers, extension of area of supply to include the borough of Stratford-upon-Avon and the urban districts of Bromyard and Ledbury; transfer to the company of the undertaking authorised by the Halesowen Electric Lighting Order, 1909.

Brixham Gas and Electricity Co.—Extension of area of supply to include a portion of the urban district of Paignton; revocation of the powers of supply of electricity within the added area of the Paignton Electric Light and Power Co., Ltd.

East Devon Electricity Co., Ltd.—Transfer to the company of the Sidmouth Urban District Council electricity undertaking.

Darlington Corporation.—Further provisions as to electricity supply.

Ascot District Gas and Electricity Co.—Further powers in connection with the electricity undertaking.

Bristol Corporation.—Extension of the boundaries of the City and the inclusion of the added areas in the area of supply of electricity, &c.

Brighton Corporation.—Extension of area of electricity supply to include parts of borough of Hove, urban districts of Portslade-by-Sea and Shoreham-by-Sea and parishes of Old Shoreham and Lancing; further provision as regards electricity supply; further provisions in regard to the tramway and trolley vehicle undertakings; financial provisions, &c.

Cardiff Corporation.—Further provisions with reference to the electricity undertaking and the tramway undertaking; financial provisions, &c.

Manchester Corporation.—Further provisions as to the electricity undertaking and the tramway undertaking.

Rotherham Corporation.—Extension of area of supply of electricity; further provisions with regard to the electricity undertaking and the tramway undertaking.

Southport Corporation.—Further provisions with regard to the Corporation's electricity undertaking.

Lancaster Corporation.—Further provisions with regard to the electricity undertaking, &c.

Stoke-on-Trent.—Extension of the Corporation's limits of supply of electricity; further electricity provisions.

(b) Electric Tramways, Motor-'buses and Trolley Vehicles.

London United Tramways, Ltd.—Provision and running of trolley vehicles along all or any of the streets and roads comprised in the tramway and light railway routes of the company.

Hastings and Tramways Co., Ltd.—Powers to run on additional trolley routes in the county borough of Hastings and the borough of Bexhill.

Wednesbury Corporation.—Special powers with reference to the surrender of the lease of the tramways and granting of new lease of or the sale or assignment of the tramways, &c.

West Bromwich Corporation.—Extension of the boundary of the borough; purchase of a portion of the tramways of the South Staffordshire Tramways Co., &c., in the borough of Wednesbury and the Urban District of Darlaston, &c.; extension of Corporation's limit of supply of electricity to the added part of Walsall and the added part of Great Barr.

Portsmouth Corporation.—Power to substitute the trolley vehicle system for all the Corporation tramways in the city; further powers in connection with the electricity undertaking.

Barnsley and District.—Powers by the Yorkshire Traction Co., Ltd., to abandon certain light railways constructed under the Barnsley and District Light Railway Order, 1900.

Llanelly and District Electric Supply Co., Ltd.—Powers to run trolley vehicles in the borough and rural district of Llanelly.

Birkenhead Corporation.—Powers to substitute the trolley vehicle system for all the tramways of the Corporation in the Borough and the Urban District of Bebington and Bromborough.

Newport Corporation.—Provision and running of trolley vehicles in the borough and the parish of Christchurch, &c.

Middlesex County Council.—Extension of lease of light railways and tramways; further provisions with reference to the supply of electricity and further powers for local authorities in the county for the time being authorised to supply electricity.

Rochdale Corporation.—Powers to abandon tramways on certain routes and substitute omnibuses; further powers in connection with the electricity undertaking, &c.

Liverpool Corporation.—Substitution of trolley vehicle systems for all tramways and light railways of the Corporation in the City, County Boroughs of Bootle, the Urban Districts of Litherland, Huyton with Roby and Prescot and the parishes of Netherton and Aintree; further powers in connection with the electricity undertaking, &c.

Dearne District.—Applicatiton by the Urban District Councils of Wombwell, Wath-upon-Dearne, Bolton-upon-Dearne and Thurnscoe and the Yorkshire Traction Co., Ltd., for Trolley Vehicle Provisional Orders; further provisions with respect to light railway and trolley vehicle undertakings of the Councils.

Leeds Corporation.—Construction of new tramways, &c.

Leicester Corporation.—Provision and running of trolley vehicles along existing tramway routes, &c.

Stockton-on-Tees.—Abandonment and discontinuance of certain tramways and the running of omnibuses by the Corporation along the routes of the existing tramways, &c.

Walsall Corporation.—Purchase by the Corporation of certain tramways of the South Staffordshire Tramways Co. in the Borough of Wednesbury and the Urban District of Darlaston; also the tramways, apparatus and works of the Borough Council of Wednesbury between certain boundaries, the abandonment and discontinuance when acquired and the provision and running of omnibuses, &c.

Kingston-upon-Hull Corporation. — Discontinuance of tramways when trolley vehicles or omnibuses are provided; further provisions for the tramway and trolley vehicle undertakings.

Bournemouth Corporation.—Provision and running of trolley vehicles along any tramway route within or without the borough.

Nottingham Corporation.—Construction and working of trolley vehicles along certain tramway routes.

Derby Corporation.—Provision of trolley vehicles along any streets in the borough along which the Corporation is authorised to work tramways, and also along further routes in the borough; financial provisions, &c.

Southend-on-Sea Corporation.—Further provisions relating to the light railway, trolley vehicle, &c., undertakings; financial provisions.

London County Council.—(Charing Cross Scheme).—Construction and working of tramways in the Borough of Lambeth; construction by the Southern Railway a railway in the Metropolitan Boroughs of Southwark and Lambeth; a new terminal station in the Borough of Lambeth; construction by the London Electric Railway of a new subway and booking hall and to close the existing Strand station; power to the Metropolitan District Railway Co. to demolish and reconstruct the Charing Cross station and to construct a new station.

(c) Railways.

London Electric Railway, Metropolitan District Railway, Central London Railway, and City and South London Railway Companies.—Powers for the construction of new railways, widenings, subways and works in the counties of London, Middlesex and Hertford; extension of the London

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Electric Railway northwards from Finsbury Park to Cockfosters, a mile north of East Barnet, a distance of seven miles; widening of the Metropolitan District Company's Hounslow extension railway for a distance of two miles to connect up with widenings authorised by the Act of 1926; also widening and alteration of the District Company's railway at Hammersmith; deviation of the existing Piccadilly Tube railway in the neighbourhood of Down Street and Hyde Park Corner; powers to construct booking halls and subways at Knightsbridge, Hyde Park Corner, King's Cross, Warren Street, Edgware Road, Russell Square and Marble Arch, &c.

Southern Railway.—Construction of a new railway between seven and eight miles in length, from Motspur Park station on the Raynes Park and Epsom line, to a point on the existing line between Ashstead and Leatherhead; widening of the Hounslow Loop Line; improvements at the City station of the Waterloo and City Railway.

Metropolitan Railway.—Two new railways at Wembley, one between Wembley and Great and Little Stanmore, four miles in length, and the other an extension in the Urban District of Wembley; additional capital powers.

Radio Manufacturers' Association.

Annual Dinner and Meeting.

THE third annual dinner of the Radio Manufacturers' Association was held on December 4th at the Savoy Hotel, London. Sir William Bull (president) presiding.

The chief guest of the evening was Mr. F. KELLAWAY who, in proposing the toast of the Association, said that no one would venture to make a prophecy with regard to the future of wireless, and he was of opinion that we were only at the beginning of what wireless was destined to do for mankind. The wireless industry had made a greater change in the social life of the world than any other invention since printing. There would be greater developments made during the next quarter of a century than they had seen in the past. He wished, however, to draw attention to the advantage which had been taken, in certain instances, by the charlatan and the sharepusher. Scandalous abuse had taken place in the last few years in connection with public flotations. Men holding prominent positions should be a little more careful in lending their names to the exploitation of inventions which had never been properly examined. The licences which the Marconi Company had issued to the trade had prevented the importation into this country of any substantial number of receiving sets. The latest figures available showed that the United States was annually exporting complete apparatus to the value of £1,700,000, but only £7,000 worth of the total reached this country. This apparatus was kept out by the Marconi licence and by the arrangement that the Marconi Company had made with the Radio Corporation of America and the Telefunken group in Germany.

In responding to the toast, Mr. J. T. MOULD (chairman of the Association), said that the Association had succeeded in bringing about a spirit of co-operation in the industry. Its monthly luncheons had had the effect of convincing them all that, although they were competitors, they might also be friends, and as to many matters their interests were identical, and could be more quickly advanced by united action. It commenced four years ago with a membership of 44, but it now included all the leading radio manufacturers, and the number of members had increased to 152. In pursuance of its exploitation policy the Association was now going to finance the whole of the industry by spending a large sum of money on propaganda during Radio Week in January next.

The toast of "Our Guests" was proposed by Capt. J. W. BARBER, and responded to by Lt.-Col. J. T. C. MOORE-BRABAZON. Mr. R. M. ELLIS proposed "The Press," and Mr. A. BEVERLEY BAXTER responded.

The dinner was followed by a dance and cabaret show.

Annual Meeting and Luncheon.

The annual meeting was held on the following day (December 5th), at the Hotel Cecil, when Sir William Bull again occupied the chair. After the conclusion of the formal business, including the adoption of the report and accounts and the re-election of the president and vice-presidents, there was a ballot of members of the Executive Council, the result of which was announced during a subsequent luncheon. The report refers to the negotiations with the Marconi Company regarding royalties, which resulted in the production of a standard form of agreement which the Association undertook to recommend to its members. Regulations governing the participation of members in exhibitions, other than those organised by the Association, have been drawn up. These restrict members in certain directions but do not prohibit the display of their apparatus by distributors. Mention is made of the success of the last Radio Exhibition both financially and from the point of view of the exhibitors. The R.M.A. also participated in the Manchester Radio Exhibition, and a wireless section is being organised in the next Ideal Home Exhibition. It is hoped to organise an exhibition in Glasgow in 1931. Co-operation with other bodies has continued, and particular mention is made of the liaison committee formed to keep in touch with the British Radio Valve Manufacturers' Association. The Radio Trade Committee on Broadcasting has been active. A scheme has been prepared, in conjunction with the B.B.C. and the B.R.V.M.A., with the object of assisting educational organisations to obtain and maintain apparatus for the reception of educational programmes. A pamphlet relating to the use of mains power for radio sets is being prepared, and an arrangement has been made with the Post Office to insert a clause dealing with the subject in wireless licences. After considering proposed amendments to the I.E.E. Regulations upon this matter, the Association recommended that no revision should be made. The Association is in communication with the Electricity Commissioners regarding the changing of mains apparatus upon the conversion of supply from d.c. to a.c. After considering, with other associations in the industry, the question of a radio trades benevolent fund, it was decided that the Electrical Trades Benevolent Institution should be approached with a view to its covering the radio industry as well. Owing to the clashing of the date of the proposed inquiry with the Radio Exhibition, it was decided to withdraw the application for a marking order in respect of imported radio apparatus, on the understanding that it might be renewed at a later date. The membership of the Association is now 152 and the accounts disclose a very satisfactory financial position.

In accepting the presidency for a further term, Sir WILLIAM BULL said that, while he appreciated the honour accorded to him, he thought that the Association should consider the election of somebody more intimately associated with the industry. Mr. J. T. Mould said that the Executive Council would consider Sir William's advice.

Several questions were raised under the heading "Other business." The subject of the duration of the 1930 Radio Exhibition was discussed. It was resolved that this should be left to the free discretion of the Exhibitions Committee, after a proposal to limit it to seven days had been put forward. The subject of the agreement with the Marconi Company was raised, and Mr. Mould said that it was the best which could be obtained. It was not binding upon the members who were free to negotiate better terms if they could. A member suggested that the B.B.C. should be approached with regard to the advertising of special programme items. Mr. Mould said that the B.B.C. had been asked to broadcast special programmes during Radio Week but the suggestion had not been received very sympathetically. Upon a suggestion that an association, on the lines of E.D.A. or the Telephone Development Association, should be formed for the radio industry, Mr. BOWYER-LOWE said that the Association should do that kind of work and, in fact, by organising a Radio Week, was already doing something of the sort. It was suggested that manufacturers should get together to study means of eliminating price cutting. Mr. Mould said that while the Association could not control prices, it was within its power to assist members to maintain the prices which they had fixed. The Radio Wholesalers' Federation and the Wireless Retailers' Association had already come to an agreement in this matter and they had approached the R.M.A. with a view to securing its aid.

At a subsequent luncheon brief speeches were made by Sir William Bull and Mr. Mould, and the election of the following to the Executive Council was announced:—Bowyer-Lowe Co., Ltd.; Brownie Wireless Co. (of Great Britain), Ltd.; Burndept Wireless (1928), Ltd.; Chloride Electrical Storage Co., Ltd.; Climax Radio, Ltd.; Columbia Graphophone Co., Ltd.; Dubilier Condenser Co. (1925), Ltd.; Ferranti, Ltd.; General Electric Co., Ltd.; Graham Amplion, Ltd.; Hart Collins, Ltd.; Igranic Electric Co., Ltd.; Kolster-Brandes, Ltd.; L. McMichael, Ltd.; Marconiphone Co., Ltd.; Mullard Radio Valve Co., Ltd.; Pye Radio, Ltd.; and Radio Instruments, Ltd.

Naval Assistance Refused.

One part of the United States has been so dry lately that two towns owning hydro-electric plants (Seattle and Tacoma) have been unable to maintain an adequate supply of power. They accordingly asked the U.S. Navy Department to let them have power from the Aircraft Carrier *Lexington*, which has a 212,000-h.p. generating plant. The request was refused.

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New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

New Lighting Fittings.

A new enclosed lighting unit employing special glassware designed to give an illumination approximating to that of natural diffused daylight is the "Eralite" fitting, fig. 1, which has recently been produced by Messrs. SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., 38-39, Upper Thames Street, E.C.4. The glassware used in this fitting has been designed upon a scientific basis to correct the light from the lamp, and when used in conjunction with modern electric lamps produces artificial illumination with a high degree of approximation to natural light. The light from the "Eralite" globe is intense, pleasing and free from glare, and does not emit any of the

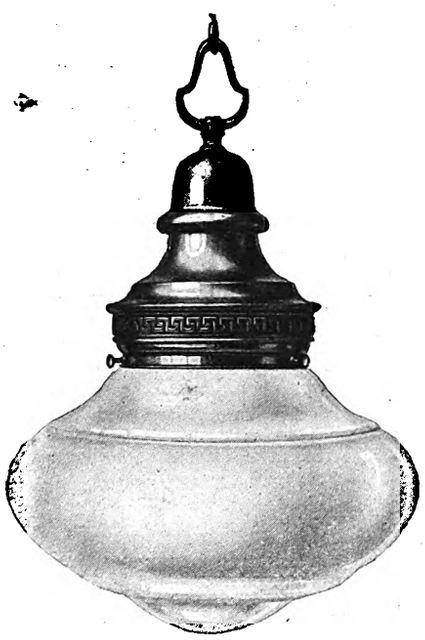

Fig. 1.—The "Eralite" Fitting.

Fig. 2.—A "Da-Ray" Unit.

light rays which are harmful to the eyes. It is claimed that colours are seen virtually in their natural tones, and that the general light effect is pleasing in character and lacking the coldness usually associated with filtered light.

Fig. 2 shows the "Da-Ray" unit recently introduced by the WHOLESALE FITTINGS CO., LTD., 23, 25, 27 & 37, Commercial Street, E.1. These fittings are the outcome of numerous experiments with "Supastone" 3-ply glass, which has attained a well-deserved popularity, as in addition to avoiding glare, the absorption factor of "Supastone" is extremely low. "Da-Ray" units give a natural diffused daylight effect, a photometric test showing a remarkably even distribution of light. The units are supplied in three sizes with 8 in., 12 in., and 14 in. diameter glassware.

A High-Voltage Indicator.

The "Martindale" high-voltage indicator, a product of MARTINDALE ELECTRIC CO., LTD., The Hyde, Hendon, N.W.9, consists of a highly sensitive neon discharge tube, designed for long life, equipped with special electrodes and assembled in a sturdy glass housing, capped with substantial brass ferrules. It will glow when subjected to comparatively low voltages and with the passage of an almost infinitely small current. Records show that an operating life of not less than ten thousand hours may reasonably be expected. The device measures 4¼ in. long by 7/16 in. diameter. There are two methods of installation: with and without ground connection. Both methods are identical, in that there is no connection between the charged cable and ground. Where no ground connection is used, the air clearance to ground provides the necessary insulation. Where ground connection is used, a heavy micarta sleeve placed about the cable gives additional security. In neither case can the cable insulation be stressed abnormally. Whether a ground wire is used or not, the tube draws its necessary power by condenser action. With a ground —and this method of installation is generally used on a.c. voltages up to about 4,000—the tube is set in the looped end of a metal strap which is in turn wrapped around additional micarta insulation placed about the cable. This strap acts as a condenser plate, and carries to the indicator a small current which jumps the gap, causing a glow, and then escapes through the ground wire. The current is only a fraction of a milliampere. On high voltages where no ground is used, the same thing occurs, but the final flow is from the brass cap on the end of the tube to ground. In this case, the end cap is one plate of an air-insulated condenser, the earth being the other plate.

A Tire-repair Unit.

Recent introductions by the B.E.N. PATENTS, LTD., 92, Tottenham Court Road, W.1, include a tire repair unit. The former is made in two types: model A, which is portable, being mounted on a castor base tripod; and model B, which is designed for mounting on a bench. Both models employ a B.E.N. flexible-shaft drive, and the design of each is such that the motor swivel and the shaft are free to rotate through 360 deg.

Plug-type Oil Fuses.

The application of the single-pole plug-type oil fuse has been rapidly extended since its introduction in this country several years ago. To keep pace with the demand Messrs. FERGUSON PAILIN, LTD., Bush House, Aldwych, W.C.2, have developed a design for 11,000-volt service and for the direct connection of bare copper conductors; this eliminates insulated cable tails and ensures a rigid connection. The main body of the fuse is of similar design to the original fuse, the chief exception being in the terminal arrangements. Each terminal consists of a bakelite-insulated copper stem, the external portion being protected from the atmosphere by a one-piece, 2-shed, petticoat-type, wet-process-method porcelain insulator. The internal end of the stem terminates in a compound-filled connection chamber fitted with an expansion cap. To minimise ground faults due to birds alighting on the unit, the bushing slopes downwards and the supporting straps are bolted to the underside of the connection chambers. Special precautions

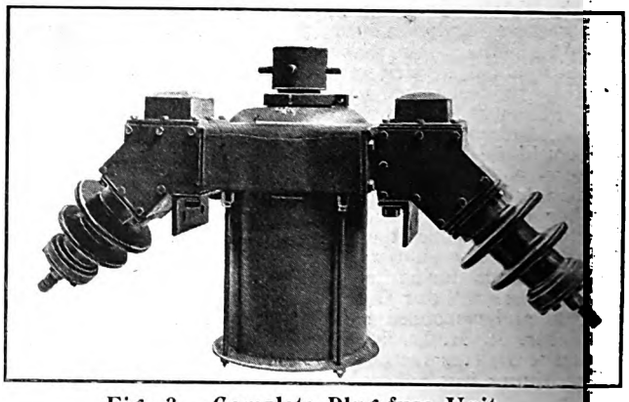

Fig. 3.—Complete Plug-fuse Unit.

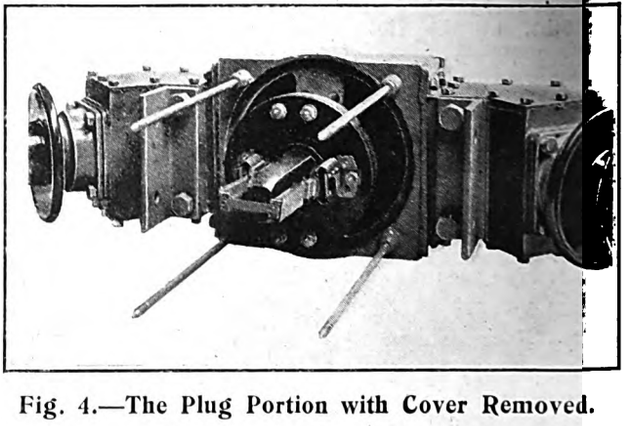

Fig. 4.—The Plug Portion with Cover Removed.

have been taken in the design of the bushings to prevent permeation of moisture and consequent breakdown of the insulation. Langite gaskets are fitted between all external clamping surfaces. Alternative designs are available for sealing cables or for terminating both cable and bare-conductor connections. Figs. 3 and 4 show, respectively, the complete plug fuse and the interior construction of the fuse portion.

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An Electric Graining Machine.

Referring to the note under the above heading in our issue of November 29th, p. 972, the address of Messrs. GUY V. LAYCOCK, LTD., is 12, Cloth Hall Street, Huddersfield, not Manchester.

An All-insulated Switch-plug.

We have received from Messrs. G. H. PARSONS, LTD., Britannia Works, Tyseley, a sample 15-A all-insulated switch-plug. The plug portion, the switch cover and dolly are in bakelite or similar material, while the switch base, which carries the socket at the top, is in enamelled porcelain. The whole is excellently finished in brown. The cable entry for the plug is at the side, and the switch terminals, while arranged for back entry, are also both on one side. The switch carries an excellent quick-make-and-break action of the "under-lift" type, and the whole of the current-carrying portion is of substantial design.

A Stud Stump Extractor.

Messrs. H. A. MCQUEEN & Co., LTD., 182, West George Street, Glasgow, C.2, have introduced a specially designed tool for removing broken studs from castings, &c. It consists of a ratchet tool and drills and millers of various sizes to suit different sized studs. The idea is first to drill a hole down the centre of the stump, and then to apply a miller, which will bite into the stump and so unscrew the latter as the tool is turned.

New Day and Night Signs.

We learn that LIGHT RADIATORS, LTD., Medway House, Old Cavendish Street, Cavendish Square, W.1, have recently introduced a range of "Light Radiator" signs for which some novel features are claimed. The signs are on the daylight principle, but they can be electrically illuminated at night, a unique feature for van use. They are double sided, totally enclosed, and have readily replaceable stencils. A universal bracket has been introduced for use on the firm's small sign, and this enables the sign to be used for standing in a window, on a counter, attached to a wall or suspended from overhead.

A Float-type Battery-charge Indicator.

We have received from Messrs. J. H. COLLIE & Co., 10, Canning Place, Liverpool, a sample of their recent production, the "Guidor" hydrometer, a robust battery-charge indicator of the float type. The hydrometer proper has a coloured scale indicating "dead battery," "half charge," and "full charge," and a number of pin-point projections round the base prevent, it is claimed, sticking to the interior of the container. The apparatus can be supplied in glass or celluloid patterns. Each indicator is sent out packed in a strong carton with a metal screw-top lid.

An Improved Shade Gallery.

A development of the "Quickfix" dome shade gallery by Messrs. SPHINX ELECTRIC, LTD., Sphinx House, Hatton Garden, E.C.1, is the "Quickfix" serrated gallery. In this, serrations round the aperture through which the lamp-holder passes take the form of incisions in the metal, stamped at such an angle that by the mere pressure of the hand the lamp-holder can be passed through the aperture to its fullest extent, and there remain firm, it is claimed, without the application of any shade-carrying ring or other device whatever. To remove the gallery all that is necessary is to unscrew the gallery complete.

The Mishap at Nechells.

An official account of the recent explosion and fire at the Prince's generating station of the Birmingham Corporation.

MR. R. A. CHATTOCK, city electrical engineer, has issued the following account of the recent mishap at the Prince's generating station of the City of Birmingham Electric Supply Department:—

At midnight on Monday, November 18th, an explosion and fire occurred in one of the transformer cubicles, in which are housed the 3,500-kW single-phase transformers which step the pressure up from 5,500 to 33,000 volts for transmission through the 3-phase 12,000-kW trunk cables. Subsequent examination showed that one of the 33,000-volt terminal chambers on the top of the transformer had been blown to pieces, owing to the terminal having gone to earth through a bakelite bushing. The oil contained in the chamber and in the conservator tank above it was released and set on fire; the force of the explosion blew open the iron doors which are interposed between the cubicle and the outside yard, and the intense heat inside the cubicle, due to the blazing oil, burned the jointing between the valve and the transformer tank which is used for draining the oil out of the tank, so allowing the main body of oil in the tank to leak into the cubicle and feed the fire. The oil, unfortunately, found its way through some apertures in the wall, through which the cooling pipes pass, and started a fire in the chamber behind the cubicle, through which the control cables from the main switchboard to the e.h.p. switch cubicles pass, and so the control cables were burnt through and the operation of the switchgear was interfered with, thus entirely shutting the station down.

The Summer Lane station and the Nechells (temporary) station were immediately called upon, and the supply of electricity was restored in that way. The provision of temporary control cables was immediately commenced, and by 7 a.m. three of the turbo-alternators, one trunk cable, and all the e.h.p. cables were at work again, and by the following afternoon the whole of the station was in commission once more.

The accompanying illustrations show (fig. 1) the exploded terminal chamber on the top of the transformer tank; (fig. 2) the effect of the explosion and fire on the cubicle doors; and (fig. 3) some of the temporary control cables that were laid during the night to replace those that were burnt out. Each of the control cables consists of a large number of cores, and each core had to be tested and connected to its proper terminals at either end, which work necessitated very great care and accuracy. The staff who handled it in the midst of the very trying conditions and surroundings are to be congratulated on the expedition and success with which it was carried out.

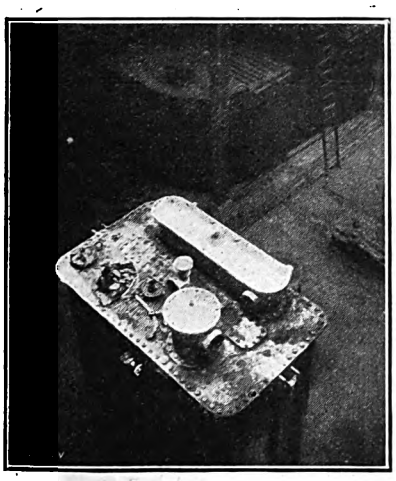

Fig. 1.—Exploded Terminal Chamber.

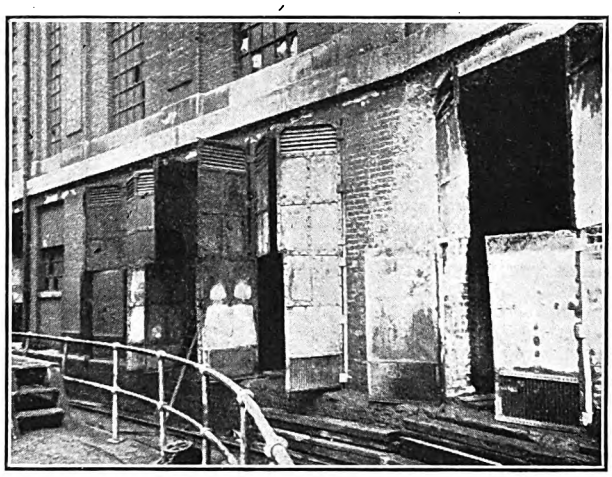

Fig. 2.—Damaged Cubicle Doors.

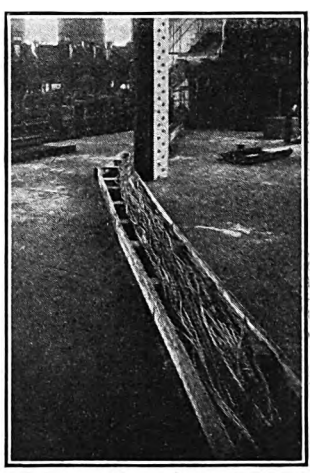

Fig. 3.—Temporary Control Cables.

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Selective Transmission-line Protection.

The Theoretical, Practical, and Financial Aspects of the Subject.

Report of an E.P.E.A. Meeting in London.

AT a recent meeting of the London local technical group of the Electrical Power Engineers' Association, over which Mr. W. J. JEFFERY presided, Mr. R. O. KAPP, B.Sc., M.I.E.E., lectured on the above-named subject, considering what reliance could be placed on selective protection, and the price that must be paid for the guarantee of continuity of supply afforded, respectively, by an alternative feed and selective protection.

When a fault occurred on a transmission system the resultant increase of current was not available for selective protection. On a complex network a faulty section probably carried less current than healthy ones, and any attempt to use the magnitude of current flowing to a fault would therefore operate against, not for, selectivity. Only if certain time delays were introduced would the mere use of overload relays be selective, and even then their field of application was very limited. The use of "tapered time limits" needed the installation of overload definite time-limit relays at the station and at each supply point on an outgoing line. Their time settings were arranged so that the one furthest from the generating station had the shortest operating time, and when a fault occurred all the relays would start to operate, but the one nearest to the fault would reach its tripping position first and clear the fault; thereupon, the remaining relays would cease moving and return to their original positions. Such protection was quite effective, if there were not too many supply points and only one feeding point, but as a rule the time settings near the generating station became excessively large. Allowing at least 0.4 second for the switch to clear the fault and an additional margin for uncertainty of operation, he did not think the time intervals of adjacent relays could safely be less than 0.7 second. With only four stations to protect, and allowing about 0.2 second initial time for a relay designed for the quickets operation and for the clearance time of the switch at the generating station, a fault near the station might be maintained for well over 3 seconds; that was too long for safe operation.

Against the very illusory advantage of long clearance times was the very real disadvantage that they were liable to cause rotary machinery to become demagnetised and consequently fall out of step, as did also any motors connected to the system, whereas its not inconsiderable quantity of energy stored mechanically and magnetically would keep the plant going if the fault were of short duration. The greatest permissible time was not easy of either theoretical or experimental proof. From tests carried out on the Bavarian 110-kV network it might be inferred that generating plant at least would remain in service if the fault did not last more than two seconds. A good deal of motor plant was likely to drop out of step during that period, however, rotary convertors being sensitive on account of the small amount of mechanical energy stored in them, and motor-generators because they could not relieve themselves of their d.c. load. No hard and fast rule could be made, but he suggested that on systems of any importance faults must be cleared in less than two seconds. A further disadvantage when protecting ring mains was the dependence on directional polarised relays, as it was not always safe to rely on voltage.

If protection by "tapered time limits" was the cheapest, crudest, and generally involved the biggest clearance times, balanced protective systems on the Merz-Price principle were at the other extreme; they were most expensive, but also most serviceable, had the outstanding advantage of very short clearance times, and did not depend on voltage either for operation or selectivity. A drawback was the charging current of the pilot cable, which tended to simulate a fault on the line and was more pronounced as the length of the pilot wire increased; therefore, the difficulties of applying balanced protection of a requisite sensitiveness increased with increasing length of transmission line.

Accordingly various refinements had been introduced, two of which deserved special mention: the split-pilot Reyrolle system was such that the effect of charging current in the pilot was self-neutralising, and the "Translay" Metropolitan-Vickers system introduced a compensating winding to make the relay inoperative to the charging current in the pilot; compensation could only be made complete for the fundamental frequency, and, therefore, harmonics in the wave form were liable to simulate a fault and produce false operation if the relay setting were very sensitive.

The high degree of sensitiveness of balanced protective systems was an achievement almost entirely British; it was, however, only of importance on circuits on which very small faults could exist, such as the windings of generators and transformers. When the dielectric stresses in the insulation were high the least failure must almost instantly develop into a very substantial fault. There could be no leakage or slowly-growing faults and, therefore, overhead transmission lines and very-high-pressure cables could not make use of a very sensitive protective system; but the habit of requiring a high degree of sensitiveness had become so ingrained that engineers were inclined to call for it even when it was not needed.

The chief drawback to balanced protective systems of the Merz-Price type was that of expense. When a very high degree of sensitiveness was required it was the only thoroughly serviceable system at present available, but when sensitiveness could not be made of cheaper systems would do, and of them the most promising was impedance protection, others being the split-conductor and parallel-feeder systems. Split-conductor cable was a good deal more expensive than an ordinary cable for the same carrying capacity, so this system had the same disadvantage of expense as the Merz-Price system. The cost of parallel-feeder protection was only that of the terminal gear and was, therefore, low, but it was operative only so long as both circuits were in service and some accessory form of protection, such as overload relays, was necessary to meet the case of one of the two circuits being switched out. Another restriction to its applicability was that tappings along the route could only be made if both lines were looped into every point, which meant that every tapping point must have four feeder switches and two sets of parallel-feeder protective gear, in addition to the switches for the outgoing supply; the minimum was likely to be a substation with six or seven switches, and tapping a line protected on the parallel-feeder principle was very costly. Another disadvantage of parallel-feeder protection of certain lines was the difficulty of ensuring operation if the fault were on one of the lines and near the end receiving the supply.

The various systems of distance, impedance, and reactance protection resembled the "tapered time limit" method in one respect. The aim of all impedance systems was to obtain as short a clearance time as possible, compatible with certain discrimination. It must always be remembered that there was a certain necessary lapse of time between the tripping of the relay and the clearing of the fault by the switch. The ideal was a relay which operated quickly when the fault was in its own section and as slowly as possible when the fault was outside its section, which ideal was attained by the quadratic relay of Messrs. Everett Edgcumbe & Co. in a very simple manner, and the same object was obtained by the ohmmeter relay of Messrs. Reyrolle & Co. in another way, while the Metropolitan-Vickers Co.'s definite impedance relay did not operate at all if the fault were much beyond the section to be protected, whereas its operating speed was great for close faults. These recent developments constituted a very marked improvement in the art of impedance protection.

Short sections could not safely be protected on the impedance principle, unless one was prepared to allow most of the running plant to fall out of step when a fault occurred; also there would not be enough voltage for the relays in the healthy sections to have any effect and those in sections adjoining a fault would then operate. For this reason, impedance protection was non-selective for very short lines, and he suggested that ten miles was a fair average.

When the sections of line were too short for impedance protection to be serviceable it was necessary in the present state of the art to employ pilot-wire protection. The balanced system was the most satisfactory for operating cables, but for overhead lines its cost was very heavy; the minimum that one could allow was £500 per mile. Pilot wires supported on the masts were cheaper, but the masts had to be higher and stronger to carry them and induced voltages when earth faults occurred might be great enough to break down the insulation and caused the resultant currents to simulate a fault on healthy sections, causing false operation. Many methods had been suggested for cheapening the pilot wire, including one developed by Mr. C. G. Carrothers and Mr. R. O. Kapp. A single copper pilot wire was employed in the earth wire of the transmission line. It was paper insulated, lead-covered, and replaced the steel centre coil of the earth wire; a non-crystallising lead alloy was used. That copper wire with earth return carried a continuous-current impulse on the occurrence of a fault, and directional relays at each end of each section operated to cause current to flow in the pilot wire in the direction in which the fault current flowed, *i.e.*, in the opposite direction from that employed by the inter-lock system. The continuous current caused the tripping of the switch at the far end of the section, provided the directional relay at that end pointed in the opposite direction. Relays pointing in opposite directions at the two ends of one section indicated a fault on that section, and it was only under those circumstances that the tripping of the switches could occur. If the pilot wire were destroyed when the fault occurred,

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operation was not prevented thereby, because the terminal gear employed the method of duplex telegraphy, the tripping signals being given in duplex simultaneously from each end of the faulty line. The tripping circuit was closed at each end of the faulty line and nowhere else, whether or not the pilot wire existed on that section. Such an earth wire had a slightly larger diameter than an ordinary one, and the mast designer must take account of it, for it might increase the cost of the mast besides adding the cost of the earth wire itself. The extra cost per mile when employing that earth wire worked out at £100 per mile on a 132-kV circuit, and £30 per mile on a 33-kV circuit.

No pilot wire was needed for a method that had been applied successfully in the United States. The power lines themselves acted as pilots, the relay operation being obtained by means of high-frequency carrier current. There would seem to be great possibilities in that system, though at present he did not think it had reached the state at which it was very acceptable to the operating engineer. It depended upon the maintenance in working order of rather a large number of thermionic valves, and a system which might fail to clear a fault because some delicate part of the gear was not in working order was, in his view, wrong in principle.

There were now available a variety of different forms of protection, all of which looked very promising, but were all experimental. One might hazard a guess that when the perfect protective system arrived it would be on quite different lines from those along which they were at present moving.

Discussion in London.

Mr. W. J. JEFFERY, chairman, commented upon the satisfactory nature of balanced protection for high-voltage mains, the only dissatisfaction he had heard expressed by mains engineers being that they had very great difficulty in finding the faults which were tripped out by the protective apparatus.

Mr. A. E. DREW agreed that the Merz-Price system was extraordinarily reliable, but it failed to deal with any fault outside its particular section. In the event of a circuit breaker on that particular section holding up, there would be nothing to remove the fault. Similarly, impedance relays had been given a rising time characteristic, so that the further the relay was from the fault the longer the time which elapsed before it operated. That was rather a disadvantage, because if anything prevented the operation of the relays nearest the fault, the fault would not be removed. In one particular relay an attempt had been made to overcome that difficulty by the addition of an auxiliary disk, so that if the main disk failed to complete its travel the auxiliary disk would rotate and so ensured the operation of the relay.

Dr. A. H. ALLEN asked if it were really necessary to provide protection at all, because he understood that in Sweden protection was not provided against faults on high-voltage lines. The policy there was to provide against the occurrence of faults by adopting exceedingly high factors of safety, the number of faults experienced being very small indeed. One must bear in mind, of course, the saving effected by dispensing with protective apparatus, but the extra cost of providing particularly robust apparatus must be set off against that.

Mr. A. WATSON suggested that if no protection were provided, a fault would damage the line and the cost of repairing it would be serious.

Mr. R. O. KAPP, replying, said that the Central Electricity Board was still young, and protection was not the very first thing it had had to tackle, but the systems so far adopted were the Metropolitan-Vickers impedance system in Scotland; the Reyrolle reactance system in south-east England; for shorter lengths the "Translay" system in Scotland and the Reyrolle split-pilot system in south-east England; and his duplex system with an embodied pilot wire in the earth wire on a short line from Stockport to Macclesfield. The Board was investigating other possibilities, of course, and until it had had a few years operating experience of the grid it did not wish to take chances. On the British grid the protective systems were all designed to protect against phase-to-phase faults as well as against earth faults. The minimum cost of balanced pilots would be about £500 per mile in open country, where trenching was easy, but in towns the cost would be probably £700 per mile at least. The system using a pilot wire embodied in the earth wire might cost £30 or £100 per mile, according to the conditions. It was difficult, however, to estimate the cost per mile of providing impedance protection.

American Million-Volt Experiments.

The Use of a Portable Extra-high-voltage Generator for Testing Transmission Lines.

ENGINEERS who have been working every day this summer in Michigan with a million volts are collecting the first accurate full-scale information regarding the amount of corona loss and the time in which it occurs on electricity transmission lines. The experience of one of them well illustrates the corona effect. While other engineers were injecting million-volt charges into a transmission line at a point eight miles away, he sat on the running board of his motor car, adjacent to one of the voltage-recording instruments attached to a transmission tower. Suddenly he felt a distinct shock; his car, insulated from ground by the tires, had collected some of the electrostatic charge of the million volts, and that charge had escaped to ground through his body. Had it not been for the peculiar circumstances in which he had placed himself, however, he would not have received any shock. Engineers near other towers, even though miles from where the million volts entered the line, reported that they could hear a crackling noise as the h.p. charge passed along the line.

One of the first 110,000-volt transmission lines in the United States was installed years ago from the hydro-electric generating station on the Muskegon River at Croton, Mich., south to Grand Rapids, a distance of 45 miles. That line is now one of four high-voltage lines through the territory, and it has been found possible by the Consumers' Power Company this summer to hold the line as a spare, and it was therefore made available for a co-operative investigation with the Westinghouse Co. of high-voltage phenomena in which a new portable million-volt generator was used.*

Mounted on a motor track trailer, it somewhat resembles a fire-hose tower or hook and ladder. While being moved across country the appartus is held horizontally on the trailer and covered with metal hoods. Arriving at the spot where the artificial lighting is to be applied to the transmission line, the hoods are removed and one end of the rack is elevated by an electric motor and connected to the transmission wire overhead. On the rack are numerous condensers, eighty 25,000-volt units connected as a series of 40 pairs. By means of a transformer connected to the customary 110-volt lighting circuit, the condensers are charged and then discharged, practically instantly, in forty successive sparks from the bottom of the rack to the top, so that the final discharge into the transmission line is of a million volts. The apparatus is such that the charges can be "shot" into the line at the rate of about one each minute, and any desired number of such "shots" can be generated in rapid succession.

From Croton to Grand Rapids are two high-voltage transmission lines, and near the Croton station there is also a 140,000-volt line not connected to the station. Along the 140,000-volt line the Consumers' Power Company is collaborating with Purdue University in studying the effect of natural lightning on transmission systems and electrical equipment. For this work, which has resulted in obtaining two natural lightning records, is employed a hot-cathode oscillograph designed by Mr. R. H. George, research associate in the high-voltage engineering experimental station at Purdue University. The oscillograph is connected to the 140,000-volt line at the point where it passes nearest to the Croton generating station. So that it may be used for the work with artificial lightning on the second line, four additional transmission towers have been erected and strung so that the three wires of the 110,000-volt system can be led to the oscillograph. The instrument, then, can be connected to both the 140,000-volt line for obtaining natural lightning records during electrical storms and to the 110,000-volt line for recording the million-volt generator surges. In addition to the oscillograph, which records the exact characteristics of the million-volt wave as put into the line, sphere gaps are installed along the line for measuring the voltage drop as the surge extends over added miles of wire; and an automatic surge recorder further adds to the information the engineers are obtaining.

In conducting the investigations, the three wires of the transmission line are disconnected from the system and the portable generator connected to one wire of the line. With the oscillograph connected at the Croton end of the line, and the sphere gaps and surge recorder at other strategic points along the line, a switch is closed at the generator, there is a slight humming noise, and (in 60 seconds) a loud snap is heard as the line of condensers discharge into the line. The engineers at the different recording instruments make their

* See also p. 1072, this issue.

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measurements and adjust their apparatus. The test is repeated many times, perhaps under varying conditions, and the different instrument readings are then collected and charted. In one series of tests 400,000-volt surges were repeatedly impressed on the middle wire of the three-wire system. The sphere-gap readings along the line showed that the voltage dropped from 400,000 at the source to half that value seven miles away, and to only 50,000 volts at a distance of 35 miles. At the same time the surge induced a voltage in the other two wires of the system of a value of from 100,000 to 140,000 volts at the source down to 50,000 volts at a point 35 miles away. This investigation, the first one on a large scale, showed how rapidly a high-voltage surge is dissipated, chiefly by the resistance of the line and the loss by corona. This type of surge is but one of several being studied this season in Michigan to determine the best method by which to protect the transmission system from damage by natural lightning. The new generator makes it possible to test lines at any place and to ascertain the amount of protection provided for them.

Kinema Lighting.

Particulars of the Installation at the New Tivoli Picture Theatre at Partick, Glasgow.

MANY new and interesting decorative features have been incorporated in the interior lighting scheme of the Tivoli Theatre, Partick, Glasgow. The general effect, whilst simple and dignified, represents a combination of decorative art, an idea of which may be gained from the illustrations below. Fig 1 is a view of the stage, proscenium, and organ grilles, from the back of the stalls; and fig. 2 is a view of the auditorium seen from the stage. Throughout the auditorium and on the stage lighting effects in four colours, or any combination of them, are obtainable by means of the dimming apparatus installed.

Four main lighting units are suspended from the ceiling over the stalls, these units being formed of double-tier rippled glass panels, each housing 48 lamps in four colours. The illumination of the proscenium front is secured by means of a continuous reflector which extends the full width of the theatre, involving upwards of 280 20-watt colour-sprayed lamps. This reflector is housed in such a manner that it is screened from the auditorium. Similar reflector lighting is provided for the organ grilles and over the front and back of the balcony. For the general lighting of the corridors on either side of the theatre, below and above the balcony, four-light ceiling fittings have been adopted, each lamp being of a different colour. Underneath the balcony three large ceiling fittings are suspended, each housing 16 100-watt lamps of four distinct colours. The under-balcony lighting effect is therefore contrived in a manner similar to the auditorium and over-balcony.

Provision has been made for the illumination of the conductor's platform, which is formed of plate glass, trough reflectors equipped with lamps of four colours being fitted in a compartment beneath the platform, thereby permitting light, in any of the four colours or any combination of them, to be projected upwards

In addition to the ceiling fittings for general lighting, small trough reflector fittings have been provided for the illumination of the side corridors during performances. These reflector fittings are so designed and fitted as to be invisible from any part of the auditorium, and they illuminate the mural decorations on the side walls, which latter portray woodland and mountain scenery. In consequence, the illusion is created that moonlit woodland and mountain scenes are viewed through colonnades. It is one of the most novel systems of corridor pilot lighting yet impressed into the service of the picture theatre, and provides a striking decorative spectacle during the film presentations. Particular care has been exercised in the design of the pilot fittings for the lighting of the centre gangways in the balcony and under the balcony. They are so constructed that a beam of light is projected the full length of each gangway, whilst the source of light is entirely hidden from the view of patrons. Furthermore, this beam of light is so arranged that it covers the width of each gangway without the rays being directed on to the occupants of seats adjacent to the gangway.

A number of large ceiling fittings, *en suite* with the auditorium units, are installed in the covered forecourt at the entrance to the building, whilst the entrance hall is lighted by means of demi-coupe wall brackets and illuminated leadglass panels, the latter representaing mural decorations.

The equipment of this theatre, from a lighting and decorative point of view, is quite different, it is claimed, from anything that has hitherto been installed in this country. The architects were Messrs. Denny & Blain, and the consulting engineer was Mr. Alexander Ramsay. The electrical contractors were Messrs. Primrose & Primrose, Ltd., the special electric lighting fittings being designed by the General Electric Co., Ltd., in consultation with the architects and the engineer.

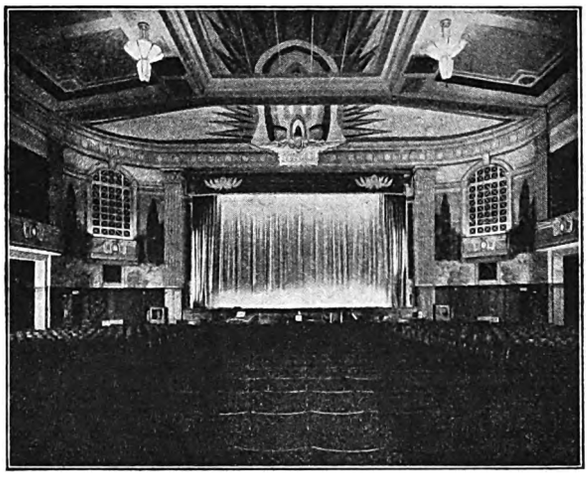

Fig. 1.—" Tivoli " Stage and Proscenium.

Fig. 2.—View of Auditorium from Stage.

Journal Bearing Practice.

Mr. Francis Hodgkinson, of Philadelphia, U.S.A., recently submitted a paper to the British Institution of Mechanical Engine-rs in which he considers principally the problems of bearings for such machines as dynamos, motors, steam turbines, and the like, when flooded lubrication is applied and the machinery must be placed in operation with the full load on the bearing. An important factor is knowledge of the centrifugal action of the lubricant when it is squeezed between the surfaces; that is to say, the fan-like path of the oil particles when subjected to pressure, and the relative motion of the surfaces. In this respect there would seem to be room for research, but, even without it, the author has no hesitation in affirming that the bearing loads which are common practice to-day may be much increased, with a slight gain in overall efficiency of the machinery and in many cases a substantial shortening of turbine generator sets, motor-generator sets, &c.

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The Rationalisation of Industry.

Some economic aspects of, and ideas regarding, the commercial development of industry as affected by existing conditions, which have grown up since the 1914-18 European war.

By S. B. HASLAM.

(*Extracts from chairman's address before the* WESTERN CENTRE *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE general trend of industry to group and amalgamate provides problems which are more vital and more deeply seated than any others. The work of the Central Electricity Board is a noteworthy example of grouping. What the result will be time alone will show, but it may be taken for granted that for the present the supply side of our industry is being tackled in a comprehensive manner; on the manufacturing side some drastic reorganisation will be necessary if we are to maintain our position, compared with foreign rivals. It is difficult to decide on the importance of the foreign market; generally, export business is not, in itself, remunerative to any manufacturer, but nevertheless it is of paramount importance in that the load factor of the factory can be considerably improved thereby, with resulting benefits to the home market and to the manufacturer's own cost of production.

During the last three years electrical plant export business was divided almost equally between this country, the United States, and Germany; unfortunately, in 1928 both of our competitors secured a slightly larger share than us and, if we remove from the total export figures the value of the electrical goods sent to other parts of the British Empire, our share of the foreign trade compares very badly with those of our chief competitors. In this connection an article recently published* is of interest.

To students of the general industrial situation the most noteworthy feature has been the wonderful revival of Germany in the past three or four years, the cause of which may be summed up in the one word "rationalisation." The maintenance of prices, or the elimination of competition, is not part of the scheme. Rationalisation is understood as "The methods of technique and organisation designed to secure the minimum waste of either effort or material." It includes the scientific organisation of labour, "standardisation both of material and products, simplification of processes, and improvements in the system of transport and marketing."

Financial conditions forced its development in Germany before the necessity became so overwhelming in this country. Rationalisation was first applied to the coal industry, and later spread to the electrical, chemical, artificial silk, and textile industries, and the principal results may be summarised as follows:—

(*a*) A rise in individual output following the closing of the less efficient mines and works, the concentration of full-time production in those best adapted for preservation and extension, and a rapid progress in the modernisation of plant.

(*b*) A steady improvement in the physique and morale of the workers, due to the rise in wages and standard of living.

(*c*) The elimination of duplicated activities and other forms of waste of labour and plant.

(*d*) An immense reduction in transport costs, due to the allocation of production to particular works for particular purposes and centralised control of the movement of raw materials and finished goods.

(*e*) An advance in full utilisation and progress in general technical and scientific practice and further concentration of sales organisations.

While it is not possible at this period definitely to say that the improvements in German industrial conditions are permanent, there is very substantial evidence that they are founded on solid ground. Fundamentally, the Englishman is not temperamentally suited to rationalisation; he is by nature and upbringing an individualist. Amalgamation with one centralised organisation tends to split up the organisations into sub-divisions, each dealing with a particular portion of the industry; the effect is "mechanisation," and the human element becomes reduced to a minimum. The old capable all-round business man in charge of the whole business is rapidly giving place to the young departmental head specialising in his own particular branch, but, unfortunately, too often he has not the advantage of a general all-round training, and therein weakness lies. Standardisation and specialisation of both industry and labour undoubtedly tend towards the cheapening of a commodity and a higher efficiency in organisation, but they also lead to a much larger number of purely routine workers and a shortage of all-round experienced leaders. The ultimate measure of success will depend largely upon whether this weakness of modern organisation can be overcome; otherwise our industries will in the future be dependent on an army of specialists who will know very little themselves of the actual internal organisation of their own concern.

The system which has proved so successful in Germany is being put into practice in this country in most of our industries. Time alone can show what the results will be, but it is to be hoped that those who control and direct the combines will realise that the object to be aimed at is economy and, therefore, lower prices, coupled with higher wages and better working conditions.

If rationalisation, complete or in a modified form, when put into operation in this country produces results similar to those obtained in Germany, increased production will result. This country cannot absorb such an increase and, therefore, markets in the Dominions and Colonies and abroad must be found, and, when found, retained. Political activities will undoubtedly have considerable bearing on this problem, but when all is said and done the two chief factors will be the salesman and the publicity man.

It is my very definite opinion that it is to the salesman that our industries must look if our old-time pre-eminence in engineering development is to be recovered. This applies chiefly to the foreign markets, which become more and more of vital importance. The man sent out to get orders must be carefully selected; he must be a skilled trained engineer with a good and definite personality; he must be able to examine and advise on the work to be done; to calculate and guarantee the time of performance; to set up and start the plant when delivered, and, finally, by actual demonstration, if necessary, to prove that his statements and advice were correct. In other words, only the best trained and equipped men should be selected. When, in addition to the qualifications above mentioned, it is realised that for foreign business the salesman or the commercial engineer, must know at least two foreign languages and speak and write them fluently, and must also study the manners and customs of the country in which he operates, it will be realised that his is no easy task and, therefore, is all the more worthy of encouragement. He must put himself in the place of the man at the works who reads his reports and enable him to grasp what is wanted in the way of design and estimate, while the manufacturer must place implicit confidence in those reports, and must remember that the man on the spot knows the local conditions, and should those conditions call for re-design he must be prepared to re-design if he wants his share of this business.

One of the benefits to be derived from amalgamation will be the restriction of advertisements, and the money thus saved will prove of inestimable value, whether put back into the industry for research and development, or given to the public by way of reduced prices. Of course, these remarks do not apply when dealing with foreign trade, as in that case foreign competition has to be met. For the home markets the propaganda work carried out by the British Electrical Development Association can be relied upon to do what is necessary to increase the number of users of electricity, and it is my serious suggestion that greater support of that Association by manufacturers and supply authorities will give good results, and at the same time materially reduce the individual advertising allocations of the subscribers.

In our industry reorganisation on rational lines is necessary on the production, distributing, and operating sides. Old-fashioned methods must go, and a new vision must materialise. The danger of amalgamations genuinely formed for better and cheaper production becoming debased into price-maintenance cartels must not be overlooked. Another danger lies in the suppression of individual thought and effort; it is that which distinguishes British goods all over the world. The standard of commercial engineering must be raised and recognised, and both manufacturers and users must realise that it is only by co-operation that the industry can survive the great trade struggle between this country and its foreign rivals which is now commencing. The next few years will witness competition from abroad the like of which has never yet been seen; we need not fear it as regards quality; we can meet it in price, if we realise what we have to do and set about it. We can regain the markets of the world, if we abandon our somewhat insular methods and appreciate that the man who pays the piper has a right to call the tune.

* "The World's Electrical Exports," ELEC. REV., 1929, Vol. 105, p. 515.

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Transmission Line Surges.

Over-voltage transient phenomena due to lightning and switching disturbances an apparatus used for their investigation.

(*Extracts from a lecture delivered before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

IN the course of his lecture on the above subject Dr. H. NORINDER pointed out, *inter alia*, that lightning surges on high-voltage transmission lines had always been troublesome, and the importance of the problem had increased with the general development of long-distance high-voltage transmission. The yearly losses due to lightning thus tended to become higher with the extended use of electric power for such purposes as railway working, because the economic effect of the interruption of the supply due to lightning would be much more serious than when used for less important purposes. Therefore the problem of protection against lightning surges was of no small economic consequence.

The earlier methods of dealing with lightning surge problems were now antiquated and primitive, and the whole problem had been transferred to a region wherein purely scientific methods could and must be applied. The adequate construction of lightning surge protective devices involved an exact and full acquaintance with the source of the trouble, the natural lightning surges themselves.

The development during the past 15 years of high-vacuum technics in general had led to the construction of special devices for research into the effects of lightning on transmission lines. There were now three groups of instruments that provided possibilities for rational research into lighting problems. They were klydonographs, cathode-ray oscillographs, and lightning surge generators. A cathode-ray oscillograph, on the one hand, with its accessories in the form of kenetron rectifiers, oscillator circuits, and evacuation systems, represented quite a laboratory. The klydonograph, on the other hand, with its astonishingly simplified construction, represented quite the reverse. The main part of the klydonograph was a small insulated electrode which was pressed against the sensitive layer of a photographic plate, whose other side was covered by an earth-connected metal plate. In the case of the cathode-ray oscillograph the cathode rays impinged on a photographic plate, or film, situated within the vacuum tube of the oscillograph. The intense bombardment of the electron jet on the photographic plate made it possible to record transient phenomena during parts of a millionth of a second.

Both the klydonograph and the cathode-ray oscillograph were instruments by which lightning surges could be observed, either as they were produced in a natural way on transmission lines under full load conditions, or in an artificial way in a laboratory circuit. They, therefore, could be regarded as controlling devices for lightning surges.

In the case of the surge generator, however, one had a producing device for surges under controlled conditions.

The simplicity of the klydonograph was one of the reasons for its widespread use on transmission systems, but, whilst it gave the amplitude and polarities of the surges, it failed in recording phenomena with time variations of a few microseconds. Nevertheless the klydonograph represented a very reliable control instrument for surges on transmission-line systems, and Dr. Norinder considered that it was worthy of more extended use.

The only suitable device for obtaining complete records of lightning surges, however, was the cathode-ray oscillograph, but the main difficulty in its use was the impossibility of foretelling the time of arrival of the surge. For that reason the oscillograph must be kept ready to record perhaps for an hour or more and during that time the film must be protected from the cathode beam and its stray radiation. Without such precautions the rays would blacken the film within a fraction of a second and no trace of a record would be visible. Further, even when a record had been taken, the film must still be protected against the radiation from the electron beam.

That special problem could be solved in two ways: in both cases the cathode ray was kept at its normal strength in the instrument during its whole time of exposure. The beam was prevented from striking the photographic layer by a special beam-blackening device, consisting of an external relay which was tripped by the first arriving impulse of the surge; the relay, which made the record, consisted of a set of electron tubes, but was too complicated in Dr. Norinder's opinion and created a great deal of difficulty. Therefore, he had devised another method in which he used the electron beam itself in the oscillograph to give the relay function, and it was claimed that it gives much quicker results, the whole effect being given by the electron beam of the oscillograph.

The construction of surge generators offered some difficulties with regard to high-voltage insulation and the elimination of superimposed high-frequency from the circuits. The voltage of kenotrons was limited to about 200 kilovolts, but for a surge generator it was sometimes necessary to go up to more than ten times that value. Another inconvenience was the necessity for relatively high effects in the lightning generators. A device for overcoming these difficulties, which had been developed by the American Westinghouse Electric & Manufacturing Co., was described and illustrated. The generator consisted of several groups of condenser banks, spark gaps, and resistances, and was claimed to have shown great flexibility as a lightning surge generator. The condensers were charged from a kenotron rectifier over resistances of the order of one megohm. One of the spark gaps was set to about 20 per cent. lower spark-over voltage than the other ones, and by the regulation of the voltage of the rectifier, a very high voltage could be reached in the system. Two of the condenser groups got a higher voltage than the others, and the spark gaps of those groups were immediately broken down. The device was diagrammatically illustrated, and photographs were shown of such a generator for 3.5 million volts in the high-voltage laboratory of the American Westinghouse Co., and also of a portable lightning-surge generator for one million volts, which was used last summer for artificial surge generation on a 220-kilovolt line.* Oscillograms were also shown indicating the regularity of the voltage variation, one record of 2,000 kilovolts being specially pointed out as showing the voltage rising to its full value within a half micro-second.

Dr. Norinder then discussed external arrangements for the connection of oscillographs and klydonographs to transmission lines, and pointed out that one of the predominant advantages of the klydonograph and the cathode-ray oscillograph was the relatively small effects necessary to produce the records. That fact permitted of the connection to a high-voltage line being made by means of capacities. It was possible, he said, to use a string of insulators in the form of a potentiometer, precautions being taken with regard to proper oscillations in the circuit leading to the oscillograph. The influence of leakage over insulators during rain and disturbance by corona must also be avoided, which could be done by using aerial air condensers in the circuit. Sometimes insulator strings suspended within the laboratory had been used in combination with air condensers. A view of such an outdoor arrangement in connection with transmission lines at Uppsala was shown, as was also an arrangement of potentiometer rings used last summer by the American Westinghouse Co. at its lightning research laboratory in New Gersey on a 220-kilovolt line.

One of the difficulties when connecting a cathode-ray oscillograph to a transmission line under full load was the elimination of the normal load voltage which was impressed on the deviation system of the oscillograph. One method was to use a relatively wide target. The normal voltage in such a case was so regulated that the electron jet would oscillate over the target under normal load voltage and only an excess of the normal voltage would cause the jet to go off from the target and strike over the film. Sometimes it was convenient to use a non-inductive resistance above the condenser of the instrument.

Dr. Norinder then went on to discuss electro-physical conditions of lightning-surges, *viz.*, surges by direct strokes and surges by induced charges, and pointed out from a physical point of view how there was a distinct difference between the two. In that connection he referred to Dr. G. C. Simpson's twentieth Kelvin lecture on this subject before the I.E.E. last session.

The final part of the lecture gave experimental data on the rate of cloud discharge, together with characteristic records of the discharge rate, all of which were accompanied by a number of illustrations. In conclusion, it was stated that it was not possible to obtain definite data of lightning surges from the records that had been exhibited, and therefore a great deal of caution was necessary in interpreting the results. Much work still remained to be done to make the knowledge of the subject more complete and definite, and it was suggested that one would always be faced with results which would vary in their general aspects as greatly as the physical conditions that governed them, *viz.*, the thunderstorms themselves. At the same time it would, said Dr. Norinder, be possible by further research to determine more efficient methods for relieving transmission lines from the troubles caused by lightning, at any rate in a very large number of cases, if not in all. The first thing necessary was rational research on surges under normal conditions in transmission lines; next to reproduce the surges under normal controlled conditions, in order to study their influence on distribution systems. Only by working in that way was it possible to ascertain if protective devices against lightning surges would be effective.

Dr. G. C. SIMPSON said that Dr. Norinder had done most

* See p. 1069, this issue.

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important work on this subject, but, unfortunately, it was usually published only in the form of glimpses in English publications. One of his most important papers was published only in Swedish, and there had been the greatest difficulty in getting it translated. Dr. Norinder began as a pure chemist, and his first work was on atmospheric electricity. Since then he had been "captured" by engineers, and, as a consequence, had not done anything like so much useful work as a pure physicist. Nevertheless, he had done some extremely valuable work with regard to lightning surges.

Mr. B. L. GOODLET, having read the majority of the papers that had been prepared by Dr. Norinder, felt nothing but admiration for the pioneer work he was doing. There had been a good deal of work done in America and Germany with the oscillograph in connection with lightning surges, but most of it had been inspired by Dr. Norinder; most of the apparatus used incorporated details due to him. It had often been said that in England they were not paying much attention to the problem of lightning surges and transient phenomena, and that there was no impulse generator available in this country suitable for such work It was certainly true that a great deal more work had been done abroad on the subject than in England, but it was nevertheless the fact that something was being done in England. Mr. Goodlet showed a lantern slide illustrating an impulse generatoor which had been used for charges up to 1,500,000 volts, the highest voltage used in England so far. The apparatus was at Trafford Park, Manchester. Another lantern slide showed an impulse spark of over one million volts on an insulator chain, which was a duplicate of those now being used on the Scottish grid. Another lantern slide depicted the first cathode-ray oscillogram taken in this country with a voltage of one million, the duration being one-millionth of a second.

On the motion of the PRESIDENT (Sir Thomas F. Purves), a hearty vote of thanks was accorded to Dr. Norinder for his lecture.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

East Sussex Cables.

Last week Mr. MARJORIBANKS asked the Minister of Transport whether the Central Electricity Board, for the sake of preserving rural amenities, would consider the laying of underground cables instead of overhead lines in any part of the work about to be undertaken in East Sussex under the Electricity (Supply) Act, 1926, either along the main or subsidiary lines of supply.

Mr. MORRISON said he had no reason to doubt that the Board would consider all reasonable methods of erecting its lines so as to interfere with amenities as little as possible. No lines might be erected above ground without his permission, and before that permission was granted careful consideration would be given to the views of the local authorities interested.

Electrical Power in Rural Areas.

Major GLYN asked the Minister of Transport last week whether he would state the policy of the Government with regard to the establishment of efficient services of electrical power and transport in rural areas.

Mr. MORRISON said it was his desire that cheap and efficient services of electrical power and transport should be provided as far as possible in rural areas. According to his information, over 70 per cent. of the rural population was at present included within areas with an authorised supply of electricity, and applications in respect of a considerable proportion of the remaining areas were pending.

Overhead Wires Near Aerodromes.

On December 3rd Mr. EVERARD asked the Postmaster-General whether he would arrange that all telegraph and telephone wires adjoining the aerodromes of municipalities and light aeroplane clubs should be put underground.

Mr. LEES-SMITH said he was always willing to make the best arrangements practicable for diverting to underground, or to another route, overhead telegraph and telephone wires in the vicinity of aerodromes, provided that the owners of the aerodromes would bear the expense.

Wireless-telephony.

On December 3rd Sir ROBERT HAMILTON asked the Postmaster-General whether any advance had been made with the perfecting of wireless-telephony in a manner that would make the system applicable for intercommunication between islands.

Mr. LEES-SMITH said that experiments with wireless telephony had been undertaken, but up to the present the results had not been altogether encouraging. Experiments were being continued, and advantage would be taken of any development in wireless communication which might render feasible its use for intercommunication between islands.

London Subway Fires.

On December 4th Mr. DAY asked the Minister of Transport whether the Electricity Commissioners had come to any arrangement with the London County Council in view of the jury's rider in the investigation held into the two London County Council subway fires which occurred in September, 1928, in which it was stated that the London County Council's electrical system was obsolete and dangerous; and could he say whether his Department proposed to take any action for the purpose of minimising similar gas explosions in future.

Mr. MORRISON said the Electricity Commissioners informed him that the London County Council had adopted a new system of electric lighting for the Victoria Embankment, the supply being at low pressure and involving a new system of cables laid under the footway and the removal of the old lighting cables from the subway. So far as his Department was concerned, no further action was being taken at present.

Hereford Electricity Undertaking.

On December 4th Mr. MUGGERIDGE asked the Minister of Transport whether the Electricity Commissioners sanctioned the recent sale of the city of Hereford's electricity undertaking to a company or trust; whether he had knowledge of offers being made to acquire other municipal undertakings, and, if so, which; and what steps he proposed to take to safeguard the cheap distribution of electricity throughout the country, as distinct from its cheap generation, which was one of the main objects of recent legislation.

Mr. MORRISON replied that the Electricity Commissioners informed him that they had decided to hold a local inquiry before coming to a decision in this matter. With regard to other municipal undertakings, he had seen various references in the Press to proposals for acquisition, but he understood that no application for consent to any such transfer was before the Commissioners. With regard to the last part of the question, the Commissioners would not sanction any such transfer unless they were satisfied that it was accompanied by technical proposals conducing to the cheaper distribution of electricity.

Special Orders.

On December 4th Sir DOUGLAS NEWTON asked how many Special Orders for the supply of electricity were now under the consideration of the Electricity Commissioners; and what was the average time taken in getting such orders through.

Mr. MORRISON said he was informed that there were 70 Special Orders at present under consideration by the Electricity Commissioners. The average time taken in getting such Orders through, including the stages of confirmation by the Minister of Transport and approval by each House of Parliament, was between 12 and 15 months.

The Battersea Power Station.

On December 5th Sir SAMUEL HOARE asked the Minister of Transport if he could assure the House that the London Power Company would not be authorised to proceed with the full scheme of the Battersea power station until the Government chemists had made their further report, and unless that report made it clear that the danger of sulphur fumes had been eliminated.

Mr. MORRISON said that the full scheme would not be sanctioned until the committee presided over by the Government chemist had made its further report, and it was clear that adequate measures could and would be taken to avoid the dangers which might arise from sulphur fumes.

Ultra-violet Rays.

On December 5th Lieutenant-Commander KENWORTHY asked the Minister of Health, whether, in view of the differences of opinion among responsible medical authorities as to the value for tonic purposes of ultra-violet light, he would institute a full and impartial inquiry into the whole question of the value of this treatment.

Mr. GREENWOOD said the value for tonic and therapeutic purposes of ultra-violet light had formed part of the routine inquiries which had been made during recent years by medical officers of the Ministry of Health, and recorded in the annual reports of the Chief Medical Officer. Those observations were being continued, and he did not see any necessity for a fuller inquiry.

The Co-ordination of London Transport.

Last week Mr. H. MORRISON, Minister of Transport, informed Mr. Thurtle that the Government had secured the services of Sir William McLintock to act as adviser upon financial matters connected with the scheme for the co-ordination of London passenger transport.

The Grampian Hydro-electric Power Bill.

After considering this Bill for nine days, the Select Committee of the House of Lords found the preamble "not proved." The Bill had the support of the Central Electricity Board and the Electricity Commissioners, but was opposed by the Mining Association and owners of fishing rights, &c., in the area.

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Legal.

Fraudulent Consumption of Electricity.

At Preston on December 4th Frederick Fazackerly, electrician, was fined 40s. for the fraudulent consumption of electricity. According to the evidence, the supply to the defendant's premises had been cut off owing to the non-payment of an account. The defendant broke the seal which had been placed on a fuse-box, replaced the fuse, and used electricity valued at 2s. 6d. He pleaded that he had a child ill in a room which was equipped for electricity only.

Ideal Wireless Co., Ltd.

Mr. Justice Bennett, in the Chancery Division on December 9th, made an order for the compulsory winding up of this company on the petition of a judgment creditor for £320. The company did not enter an appearance.

Fellows Manufacturing Co., Ltd.

In the Chancery Division on December 9th, Mr. Justice Bennett ordered the compulsory winding up of this company.

Mr. Christie, for the petitioners, said that they were judgment creditors for £418, and they were supported by creditors for, roughly, £2,000.

Mr. Harman said he appeared for the landlords on a claim for £145; and another counsel said he appeared for Marconi's Wireless Telegraph Co., and supported the petition.

The company did not enter an appearance.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Determining Efficiencies by Slide Rule Calculation.

I shall be glad if you will correct a misprint which occurred in my letter on the above subject published in your December 6th issue.

The commencement of the second paragraph should, of course, read "By this method, although (1—efficiency) is . . . ."

W. H. Watkins,
Grad. I.E.E.

London, *December 9th*, 1929.

Bowl Fires.

In your issue dated November 8th there is a letter signed by "Chromium" suggesting that makers of electric bowl fires should produce a chromium-plated bowl, which will greatly increase the popularity of this useful appliance.

We wish to point out to you that we have for some months past standardised chromium finishes as well as lacquered copper finishes for bowl and other types of fire.

Lane & Girvan, Ltd.,
J. Fergusson, *Director.*

Bonnybridge, near Glasgow, *November 26th*, 1929.

Designation of Wireless Batteries.

The increasing custom, due no doubt to competition in this market, of several low-voltage wireless battery manufacturers to list and mark such batteries showing only an ampere-hour (actual) capacity, without at the same time giving the hour rate on which this actual capacity is based, is very misleading.

To the technical reader there is a very obvious difference in the operating and monetary value of three l.p. batteries, each listed as 45 ampere-hours capacity, one being shown at a 10- or 20-hour rate, the second marked at 45 ampere-hours, actual, and the third at low discharge rate only. Price conditions to the layman at once suggest the purchase of the lowest priced 45 ampere-hour battery, shown as ampere-hours, "actual," or the one at a low rate of discharge, although, if the second or third were marked at the 10- or 20-hour rate, they might probably only be correctly shown as 30 ampere-hours, actual, or less. I suggest that the hour rate should always be given as well as the ampere-hour capacity, and that the use of the term "actual" should be discontinued as being misleading.

Why not also standardise the physical sizes of portable wireless batteries and thereby encourage mass production methods and lower prices to the consumer? I recently studied a prominent battery manufacturer's list of low-tension portable set wireless batteries where 42 different sizes were listed. The number of sizes might be limited to between six and eight.

Perplexed.

December 4th, 1929.

Transmission 50 Miles Costs 0.0235d. per Kelvin.

In the report of my remarks on page 973 of your issue of November 29th there is an incorrect figure (seventeen times the truth) and the load factor, which is essential, was omitted. At the Overhead Lines Association meeting I quoted a statement from *The Times*, p. 16, May 20th, 1929, by the hon. secretary of the Chelsea Society, an amenities organisation, that ". . . . the transmission of 50,000 kW, 50 miles at 80 per cent. load factor adds one fortieth of a penny to the cost of each kelvin . . . . given in evidence by Major Richardson and Mr. C. H. Merz, and emphasised by the chief Electricity Commissioner . . . ." quoted by Mr. Reginald Blunt from the public records of Viscount Younger's Select Committee of the House of Lords, on April 24th, 1929, on the Grampian Water Power Bill.

Theodore Stevens.

London, *December 5th*, 1929.

Two-part Tariff Prepayment Meters.

May we be permitted to correct a statement by Mr. W. Fennell in your journal concerning our two-part tariff prepayment meters.

The type we have been selling for the past two years does not require the consumer to pay a lump sum in advance. Each coin inserted is apportioned to the fixed charge and kWh charge. There is no fixed predetermined ratio, but the ratio is automatically adjusted by the meter to suit the conditions obtaining in each consumer's case, quite independent of the kWh consumption. This is not effected by an expensive or complicated clock, but by a simple and reliable Ferraris motor.

Since our meter is not a "creeping" meter, we do not see how the question of legality arises.

A.E.G. Electric Co., Ltd.,
W. Howard.

December 3rd, 1929.

We greatly appreciate the letter of Lt.-Col. H. W. Watts, of Epsom, regarding the "Rex" and A.E.G. methods of solving the problem of collecting by prepayment methods the fixed charge and current consumption charge, as we know that he has for years past accepted the importance of such a tariff to provide a means of supplying that immense section of the population which is of very modest means and cannot meet even an account of nine or ten shillings.

If one simply transfers the job of collecting a lump sum from the accounts department to the instrument before the consumer is allowed to use any current, one tends to defeat the original idea of the tariff, which is to provide an easy method of paying for the current consumed

It has been stated by an eminent central station engineer that consumers who had to be pressed for the payment of a 9s. account for a quarter's consumption, when placed on a prepayment basis have inserted regularly amounts exceeding 40s. every quarter.

The "Rex" meter has been evolved to provide a means of enabling prepayment consumers to avail themselves of the most encouraging tariff without the necessity of finding lump sums at any time. The method of achieving this is absolutely in conformity with all rules and regulations and is legally accurate.

A special point in favour of the "Rex" method is its flexibility. Supposing there is a fixed charge based on maximum demand or ratable value, &c., of 16s., and during a current quarter the consumer decides to use a cooker at 7s. per quarter, this amount is simply added when resetting the fixed-charge collector dial, making a total for collection of 23s., and as the "Rex" can be supplied with accommodation for a fixed charge up to 99s., there is ample scope for this method of application. This deals with this side of the account much better than an electrical device which is arranged to run at a standard speed, which may become a variable factor and necessitate skilled attention to alter its speed should the fixed charge amount be varied at any time.

It must also be appreciated that the "Rex" meter does not sum up an account against the consumer should he happen to be away or any other unforeseen matters arise.

It will be seen, therefore, that the "Rex" deals with the problems in a very human manner and enables the consumer to get a supply of current at any time by the insertion of one coin only, which is more likely to encourage the more extensive use of electricity than switching off his current and forcing him to find several shillings before he gets it on again.

Thompson & Co.

London, E.C.4, *December 6th*, 1929.

[This correspondence is now closed.—Eds. Elec. Rev.]

Standardisation of Sizes of Advertisement Pages.

There is another aspect than that of the convenience of the advertiser. I refer to that of readers, many of whom appreciate that there is much news and information in many advertisements. For many years past it has not been my practice to retain old issues of journals, but rather, as I read them, to tear out the technical articles and those of the advertisements that are likely to meet the need of present or future requirements. These extracts are then filed under the well-

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known decimal subject-classification system, which has the advantage of a ready prepared index, and hence indexing, in the ordinary sense, is not required. My files are arranged for quarto size paper, and hence a large advertisement cutting has to be doubled. This means it takes more space on the file and also, on reference, is not so easily seen.

R. Borlase Matthews.

East Grinstead, Sussex, *December 6th*, 1929.

With reference to the letter of the I. S. B. A. appearing in the ELECTRICAL REVIEW of November 29th, 1929, p. 977, respecting the above, we are whole-heartedly in sympathy with this. We are advertising in a considerable number of trade journals, and our present block account is far heavier than it need be, due to the variety of size of trade journals. If these were standardised it would certainly free money for spending on extra space, expedite delivery of blocks to the publishers, and allow a change of copy more frequently.

Siemens Electric Lamps and Supplies, Ltd.,

W. W. WILLMOTT.

London, E.C.4, *December 3rd*, 1929.

Referring to the letter under the above heading appearing in your issue of November 29th, and in reply to the Editors' invitation for opinions on this matter, we would state that in our opinion the proposed standardisation of size of advertisement pages would be a big boon to all advertisers. There is no doubt that the varying sizes of journal pages very considerably increases the cost of this form of advertising, and we, for our part, would welcome a standard size of page.

Birkbys, Ltd.,

A. T. BIRKBY, *Director*.

Liversedge, Yorks., *December 6th*, 1929.

Science and Legislation.

Now that it is generally recognised that science must play a direct part in legislation, and no longer act merely in an advisory capacity, and now that there is a Science Committee in the House of Commons, an attempt is being made to set up similar committees in the Dominion House of Assembly and also in Australia. It is obvious that such developments must help in the development of the "new" industries, and it is hoped that all those who have had a scientific training will do all they can to further this development.

W. P. Dreaper, O.B.E., F.I.C.

London, *December 7th*, 1929.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1928.

13,623. "Delayed-action electric relay device. J. Neale. May 9th, 1928. (Cognate application, 14,542/28.) (321,671.)

13,832. "Thermionic valve amplifiers." F. A. Mitchell. May 10th, 1928. (321,644.)

14,290. "Telephone repeater circuit arrangements." Callender's Cable and Construction Co., Ltd., and J. Urmston. May 15th, 1928. (Cognate application, 4,820/29.) (321,673.)

14,478. "Method of manufacturing insulated electric cables." J. E. Allan and S. B. Freeman. May 17th, 1928. (321,696.)

16,811. "Electric time switches." E. W. L. Cowan, W. E. King, and Measurement, Ltd. June 9th, 1928. (321,661.)

16,921. "System of automatic control for the generation of energy in an electric power plant according to a prescribed table." Akt. Ges, Brown, Boveri et Cie. June 11th, 1927. (292,086.)

17,099. "Apparatus for measuring the strength and direction of magnetic fields." J. G. Binny. June 13th, 1928. (321,647.)

17,404. "Thermionic valve circuits." Radio Frequency Laboratories, Inc. July 20th, 1927. (294,200.)

20,419. "Eddy-current brake." E. R. & F. Turner and F. H. Johnson. July 13th, 1928. (321,663.)

23,174. "Signalling indicators for use on vehicles." V. W. Restall. August 11th, 1928. (321,677.)

23,178. "Means for dissipating the heat generated by electrical apparatus immersed in liquid within a casing." British Electric Transformer Co., Ltd., and J. L. Thompson. August 11th, 1928. (321,678.)

23,206. "Starting apparatus for internal-combustion engines." A. E. White (Delco-Remy Corporation). August 11th, 1928. (321,653.)

23,248. "Street-lighting appliances." J. Bond, G. W. A. Illingworth, and W. J. G. Davey. August 13th, 1928. (321,654.)

23,285 "Method of mounting electric leads in thermionic valves." Dr. S. Loewe. August 17th, 1927. (295,689.)

23,407. "Electrical advertising apparatus." A. Zajdler. August 14th, 1928. (321,664.)

23,503. "Electric storage batteries or electric accumulators." S. C. Whaite. August 15th, 1928. (321,681.)

23,505. "Electric signal systems." Standard Telephones and Cables, Ltd., and A. H. Reeves. August 15th, 1928. (321,682.)

23,558. "Electric relays of the time selective type." Nalder Bros. and Thompson, Ltd., and C. L. Lipman. August 15th, 1928. (321,686.)

23,567. "Mounting of vibrating reeds, more particularly for use in connection with electromagnetic gramophone pick-ups, loud-speakers, and the like." P. Wilson. August 15th, 1928. (321,688.)

23,600. "Submarine cables." W. E. Beatty (Bell Telephone Laboratories, Inc.). August 16th, 1928. (321,710.)

23,616. "Inductance coils for wireless signalling apparatus." General Electric Co., Ltd., and W. H. Peters. August 16th, 1928. (321,711.)

23,726. "Systems of electric distribution." British Thomson-Houston Co., Ltd. August 23rd, 1927. (296,025.)

24,022. "Telephone systems." Associated Telephone and Telegraph Co. September 17th, 1927. (Addition to 293,294.) (297,316.)

24,757. "Television or like systems, and apparatus therefor." Universal and General Radio Co., Ltd., and L. M. Myers. August 28th, 1928. (321,750.)

24,911. "Slow-motion or fine-adjustment mechanism for electrical tuning apparatus." L. E. Fillmore and L. W. Fillmore. August 30th, 1928. (321,752.)

24,942. "Electric discharge devices." British Thomson-Houston Co., Ltd. August 31st, 1927. (296,411.)

26,074. "Thermionic amplifiers." L. E. Ryall. September 11th, 1928. (321,759.)

27,137. "Electrically-operated track switches." S. S. Stolp. September 21st, 1928. (321,766.)

27,786. "High-frequency amplifiers." C. E. G Bailey and Gramophone Co., Ltd. September 27th, 1928. (321,771.)

28,135. "Thermostatically-controlled protective devices for electrical apparatus." Siemens Bros. & Co., Ltd., and F. J. Gee. October 1st, 1928. (321,776.)

28,277. "Moving signs and advertising and like devices." R. H. Linton and M. E. J. G. De Bray. October 2nd, 1928. (Cognate applicaation, 29,669/28.) (321,780.)

28,346. "Electric traction control systems." English Electric Co., Ltd., and F. D. H. Bremner. October 3rd, 1928. (321,781.)

29,601. "Electrical control systems." E. M. Johnson and Associated Electrical Industries, Ltd. October 13th, 1928. (321,300.)

30,869. "Electric signalling systems." Maschinenfabrik Oerlikon. November 29th, 1927. (301,418.)

30,910. "Multiple thermionic valves." Dr. S. Loewe and Dr. E. Roemhild. October 29th, 1927. (299,707.)

31,696. "Loud-speaker and like acoustic apparatus." C. French. October 3'st, 1928. (321,806.)

31,811. "High-tension switchgear installations in switch houses." Conduit Electrical Manufacturing Corporation. March 12th, 1928. (307,738.)

33,744. "Insulation of electric cables and conductors." J. McCallum. November 17th, 1928. (321,830.)

34,093. "Starting apparatus for induction electrical motors." P. L. Harlow and Associated Electrical Industries, Ltd. November 20th, 1928. (321,831.)

35,044. "Shade or globe holders and galleries." Benjamin Electric, Ltd., and G. Campbell. November 28th, 1928. (321,845.)

35,953. "Electric switches." G. Hezez and Soc. l'Appareillage Electrique de la Seine. April 12th, 1928. (309,532.)

35,959. "Ventilation of dynamo-electric machines." J. A. K Kuyser and Associated Electrical Industries, Ltd. December 6th, 1928. (321,853.)

36,966. "Toasters." British Thomson-Houston Co., Ltd. December 14th, 1927. (302,320.)

37,034. "Piezo-electric devices." Telefunken Ges. für Drahtlose Telegraphie. December 17th, 1927. (302,584.)

37,229. "Electric lighting systems for the headlights of motor vehicles." J. S. Ericsson. December 17th, 1928. (321,862.)

38,189. "Collecting electrodes for use in the electrical precipitation of suspended particles from gaseous fluids." Lodge-Cottrell, Ltd. (Metallges. Akt. Ges.). December 27th, 1928. (321,869.)

1929.

41. "Means for holding electric conductors, cables, and the like in position." Macintosh Cable Co., Ltd., and J. A. Smith. January 1st, 1929. (321,874.)

1,193. "Illuminating devices." W. Fantl. January 12th, 1928. (303,908.)

1,197. "Direction indicator for vehicles." A. Schwarz. January 12th, 1928. (303,909.)

3,157. "Electric resistances, rheostats, and dimmers." Curtis Manufacturing Co., Ltd., and F. C. Curtis. January 30th, 1929. (321,888.)

3,998. "Electrical braking systems for vehicles equipped with more than two electric motors." Forges et Ateliers de Constructions Electriques de Jeumont. February 7th, 1928. (Addition to 232,575.) (305,583.)

5,109. "Electric condensers." Elektrizitäts Akt. Ges. Hydrawerk. February 15th, 1928. (306,100.)

6,973. "Sealing cover for the cells of lead accumulators." Accumulatoren-Fabrik Akt. Ges. March 2nd, 1928. (307,294.)

8,043. "Process of manufacturing incandescent bodies." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. April 13th, 1928. (309,573.)

9,032. "Electrical transmission of pictures." British Thomson-Houston Co., Ltd. March 20th, 1928. (308,277.)

11,585. "Electric incandescent lamps." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. April 27th, 1928. (310,523.)

24,973. "Thermionic cathodes." Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.). June 13th, 1928 (Divided application on 297,028.) (321,665.)

25,232. "Electrical advertising apparatus." A. Zajdler. August 14th, 1928. (Divided application on 321,664.) (321,666.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from December 4th:—

Anthygron. Nos. 506,887, 506,888, 506,889, and 506,890. All goods in Classes 6, 8, 13 and 18.—Siemens-Schuckertwerke Gesellschaft, Siemensstadt, Berlin. (British representatives: Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, W.C.2.)

L.E.C. Liverpool (lettering and design). No. 505,073. All goods in Class 8. —Liverpool Electric Cable Co., Ltd., Linacre Works, Bootle, Liverpool.

Autovorex (lettering and design). No. 507,512. Class 8. Radio-telegraphic and telephonic instruments and apparatus.—Marcel Tavernier, Montreuil-sous-Bois, Seine, France. (British representative: Henry Fairbrother, 30-32, Ludgate Hill, E.C.4.)

Metcosite. No. 505,449. Class 50. Compositions made from vegetable fibres and pulp, and articles made therefrom, including electrical insulators, junction boxes, lampholders, panels, bases and cases for electrical and wireless instruments, &c.—Merchant Trading Co., Ltd., 52, Bishopsgate, E.C.2.

B.S.S. for Solid and Split Taper Pins.

The British Engineering Standards Association has just issued B.S.S. No. 46, Part 3, 1929, for solid and split taper pins. This Specification forms the third part of B.S. Specification No. 46, which, in being revised, has been considerably amplified to cover all methods of keying. The Specification embodies requirements for the quality of material, together with the appropriate tests, and also gives a table indicating the standard sizes for both solid and split taper pins.

Copies of the above Specification can be obtained from the British Engineering Standards Association, Publications Department, 28, Victoria Street London, S.W.1. Price 2s. 2d. post free.

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New Work for Contractor

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ARDROSSAN.—Buildings at Academy (£32,000); master of works, Ayrshire Education Authority, Ayr.

ASKAM BRYAN (NEAR YORK).—Alterations and extensions to farm buildings, for Yorkshire Council for Agricultural Education; Begg, Everard & Grierson, architects, 6, Millstone Lane, Leicester.

BARNSTAPLE.—Extensions, Plough Works, Alexandra Road, for J. Huxtable; Friend & Kelly, architects.

BILLINGHAM (STOCKTON-ON-TEES).—Additional 600 houses; Industrial Housing Association (No. 3), Ltd.

BIRKENHEAD.—Development of Manor Hill estate; T. Wainwright & Sons.

BIRMINGHAM.—Telephone exchange and labour bureau, Staniforth Street and Corporation Street; H.M. Office of Works. Branch bank, Holyhead Street, Handsworth; Municipal Bank Committee.

BOLTON.—Office and store, Endon Street; Star Auto Engineering Co.

BRIDLINGTON.—Municipal offices (£43,000), for the T.C.; borough surveyor.

BRISTOL.—Central maternity clinic, Old Bread Street; medical officer of health.

BURNLEY.—Extension of Victoria Hospital (£20,000); secretary.

CARDIFF.—Extensions to Heathfield House Girls' Secondary School and pupil teachers' centre, for the Sisters of Providence (£30,000); William Ellis, 49, Deansgate, Manchester.

CARSHALTON.—Central school, Stanley Street (£22,500); Surrey E.C.

CASTLE DONINGTON.—Additional housing scheme, with electrical work, for the R.D.C.; surveyor.

CHALFONT ST. PETER (BUCKS.).—Cinema; C. M. Street, secretary.

CHELMSFORD.—Sewerage and water supply schemes, Galleywood, with electrical work, for the T.C.; borough engineer.

CHELTENHAM.—Houses (64), Kipling Road; borough engineer.

COVENTRY.—Hospital for mental defectives; borough engineer.

CUPAR (N.B.).—Remodelling of Bell Baxter School (£30,000); executive officer, Fife Education Authority. Housing scheme (24), Balgarvie Road; borough surveyor.

DUNDEE.—Nurses' home, &c., at Baldovan Institution; MacLaren, Soutar & Salmond, architects, 15, South Tay Street.

EASTBOURNE.—Housing scheme (23 acres), Hampden Park; borough engineer.

ERITH.—Business premises, Pier Road, for F. W. Woolworth and Co., Ltd., Kingsway, London.

GLASGOW.—Buildings, Argyle Street, Buchanan Street, for Montague Burton, Ltd., Hudson Road Mills, Leeds; the manager.

HALIFAX.—Shops, offices, &c., Bull Green; borough engineer.

HIGH WYCOMBE.—Factory, Chairborough Road, for Peatey Bros. & Collins. Factory extensions, J. T. Edgerley, Frogmoor, and J. Cheese & Son, Newland.

HOLBEACH.—Cinema, for Holbeach Amusements, Ltd.; R. W. Chambers, secretary, 7, South Brink, Wisbech.

HORNCHURCH.—Senior school (£18,756), for Essex E.C.; J. Stuart, architect, Chelmsford.

HUDDERSFIELD.—Clinic, for the T.C.; borough architect, 26, Ramsden Street.

HULL.—Senior school (440 places), Dansom Street; St. Mary's Catholic School managers. Blocks of flats, Madeley Street (£56,000); city engineer. Extension (480 places), Eastfield Road School. Extensions, Guildhall (£8,500); city architect.

HYDE (CHES.).—Billiards hall and shops, Borough Arcade, for W. Stansfield; W. A. Dew, architect, Market Chambers.

ISLEWORTH.—Houses (89), Hogarth Gardens and Carrington Avenue, Hounslow; P. Chase Gardener & Co., architects. Factory, Syon Lane; J. Monro & Son.

KILMARNOCK.—Two schools for advanced division centres (£34,750 each); clerk of works, Ayrshire Education Authority, Ayr.

LEIGH (LANCS.).—Schools; director of education.

LEYLAND (LANCS.).—Bank, Hough Lane, for Preston Savings Bank; A. C. M. Lillie, architect, Dowry House, Brownedge, Bamber Bridge, near Preston.

LINCOLN.—School, St. Giles, for the City E.C.; W. G. Watkins, architect, Silver Street (returnable deposit of £2 2s.).

LIVERPOOL.—Extension of Walker Art Gallery. Housing scheme, Fazackerley Hall and Knotty Ash estates; land steward and surveyor, Municipal Buildings, Dale Street.

LONDON (LEYTON, E.).—Public wash-houses, for the T.C.; borough engineer.

(EAST HAM, E.).—Extension of Wesleyan Churches (£26,000); secretary, East Ham Wesleyan Mission Circuit.

(BLACKFRIARS, E.C.).—Extensions, School of Printing, Broadwall; L.C.C. architect.

(STAMFORD HILL, N.).—Tenements (5½ acres); L.C.C. architect.

(PECKHAM, S.E.).—Buildings site in Rye Lane, Elm Grove and South Grove; North, Robin & Wilsdon.

(BERMONDSEY, S.E.).—Re-housing scheme, Pages Walk; borough engineer

(SOUTHWARK, S.E.).—Building, Comus Place; H. Dickses, 22, Portman Street, W.1.

(LEWISHAM, S.E.).—Houses (120), L.C.C. Downham estate; J. G. Stephenson. Houses (82), Selworth Road; Walter Hall & Sons, Ltd. Flats (60), Winchfield Road; borough engineer. School, Moorside Road; J. N. P. Conlan.

(WIMBLEDON, S.W.).—Five shops and flats, Coombe Lane; E. G. W. Souster. Telephone exchange, Kingston Road; H.M. Office of Works.

MANCHESTER.—Additions Carborundum, Ltd., Trafford Park; C. Heathcote & Sons, 53, King Street.

NORTHUMBERLAND.—Schools, Ashington (£88,000), Alnwick (£23,000), Bedlington (£54,000), Earlsdon (£38,000), Gosforth (£33,500), Hexham (£22,500), and Whitley Bay (£42,000); C. Williams, secretary, Northumberland E.C., The Moothall, Newcastle-on-Tyne.

NORTON.—Housing scheme (25 acres); Stoke city engineer.

OLDHAM.—Extensions to Nurses' home, Royal Infirmary; the governors.

OXFORD.—Reconstruction, Wolvercote paper mills; Cannon and Clapperton.

PETERBOROUGH.—Reconstruction of Theatre Royal and Empire, Broadway, for J. A. Campbell, Grantham.

RENFREWSHIRE.—Sanatorium for District Committee (£100,000); W. Fairweather, chairman of the committee, Newton Mearns.

ROCHESTER.—Houses (40) and flats (40), for the T.C.; city surveyor.

ROCHFORD.—Central school for Essex E.C.; director of education, Chelmsford.

ROMFORD.—Intermediate school (£28,828), by direct labour, for Essex E.C.; J. Stuart, county architect, Chelmsford.

ROTHWELL.—Conservative club (£5,375); Col. John Brown, architect, Northampton.

SALFORD.—Schools, Lower Kersal and on Broughton Town Hall site; R. S. Martin, secretary to the education committee.

STOKE-ON-TRENT.—Housing scheme, Carmountside estate; city engineer.

STRANRAER.—Housing scheme (44), Bowling Green Road; burgh surveyor.

STREET (SOMERSET).—Re-erection of Goss Mills, for Phelps and Son, Glastonbury.

STRETFORD.—Brass foundry, Trafford Park; Royce, Ltd.

SWINDON.—School, Pinehurst, for the Borough E.C.; secretary, 22, Regent Circus (returnable deposit of £1).

VANGE (ESSEX).—Re-erection of sawmills, for Churchill, Johnson, Ltd. (£23,000).

WALSALL.—Houses (50), Forest estate; B. Denning.

WALTON-ON-THAMES.—Church, hall and Sunday schools, Hersham Road, for the Presbyterian trustees; secretary.

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FOUNDED 1872

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The

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Big Men for Big Industry.

IT is impossible to keep pace with all the thoughts that are being publicly expressed, either by speech or in writing, regarding the best ways to adopt for securing the most efficient and progressive conduct of industry in works and offices at home and of trade operations in markets overseas. One has listened to the speeches of those who knew, or thought that they knew, for a score of years, and while occasionally there has been a harvest of new propositions, the monotonous sameness of the ideas has been truly remarkable. Even the word rationalisation, which has been employed amongst us so much during the last few years, is but a re-discovery, for long before British industrialists began to see clearly regarding what it meant or what it involved, we were recording week by week in these pages how German electrical and other heavy industries were strengthening their positions by reconstructions, amalgamations, Kartels, and so forth, for a world war of trade, and the German readiness for linking up their great works for the rapid production of war munitions on a colossal scale was attributed to their advanced state of organisation. At the beginning of the year 1919, when our works were passing through that difficult period of change-over from war production to peace manufacturing, we imagined a voracious appetite throughout the world for our output. We had to give all the employment we could at that delicate time, and so we found ourselves carrying on with a capacity far in excess of order-book requirements or visible world demand. The world was too poor to buy—but we went on producing. To-day we still have much of our productive capacity unutilised and the modernisation of equipment and the reorganisation of certain industries has further greatly increased our output capacity. But all sorts of home and world problems affecting industry have dogged our steps as we have made this, that, and the other advance, and our advisers still have little more than the former object lesson of rationalisation to point to as a means of relief and permanent prosperity—we are not thinking of our legislators at the moment. Many have been the definitions given to that word rationalisation; to some authorities it is scientific management, quite an old term which has been the subject of much controversy in days gone by in engineering circles and publications. To

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others it means something which is only a part of that comprehensive term, while to other minds it means large and difficult financial and works changes.

In his address to the Western Centre of the I.E.E., abstracted in the REVIEW last week, Mr. S. B. Haslam said that rationalisation would mean increased production, and that is certainly one of the great effects it has been found to produce as a competitive power against us, because it reduces cost. But our position seems to be somewhat like that obtaining after the war, for we have not the power to absorb this increased production. We have got to find more markets—many men have been saying it for years and many others have been telling us how they think we should proceed in order to succeed in such endeavours. The ground must already be so familiar to readers of this journal that we need not particularise, but if there is one point more than another that we wish to lay emphasis upon just now, it is the need that exists for the development of a bigger type of man in the electrical industry. If, as has been suggested, the establishment of a higher type of productive organisation may lead us to employ a larger number of routine workers and cause a shortage of all-round experienced leaders, how can we regard that development with equanimity? We want more, not fewer, all-round experienced leaders on the productive side of industry, and beyond all question, to our minds, what we need on the export selling side is a substantial addition to the number of men of a high-class type; and they need not be brought in from other industries. Possibly, or shall we say probably, they are in our ranks already and only stand in need of a fair opportunity and adequate acknowledgment. We all know how seldom it is that technical and commercial qualifications are found fully developed in a man possessed of an acceptable presence and a fluency in foreign market languages. Yet we are constantly having placed before us a long list of qualifications, attainments, and virtues which, though described as urgent essentials, can only come as the result of a wide and deep experience. And when such men are found, or shall we say when they are developed, partly by their own enterprise, initiative, and hard work, and partly under a wise and generous and far-seeing policy of their employers, they are worth their weight in gold. Why do we not recognise this more frequently than we do and reward men according to their real value? Niggardliness in the recognition of men of high qualifications either on the administrative or the trade-getting side is an inexcusable and a very short-sighted failing. How long will it be before we accustom ourselves to modern money values, taxation imposts, and costs of living?

Do we not need to get on to a larger salary and remuneration basis, encouraging big men who are able to carry on under rationalised conditions, reducing costs of production so that substantial trade representatives shall find the new markets, increase the demand on the works, and reap a reasonable reward for themselves? Are present-day boards and heads of concerns ready to adopt a larger policy and assure to men of merit a reward appropriate to the results of their efforts? If they are, we need fear no lack of suitable men for what everybody now seems to regard as an extremely valuable service to the nation.

The Disposal of Surplus Energy.

THE ability to extract good out of evil fortune is one sign of a high *morale*, and but for the devastation of Lorraine in the war, and the necessity for the reconstitution of its main industries, it is probable that the spur would have been wanting to bring about the co-operation among the iron and steel companies in the province, for the purpose of disposing of electrical energy produced from surplus blast-furnace gas, which formed the subject of the I.E.E. paper last week. Interconnection between metallurgical works not only brings about the benefits associated with similar arrangements between coal-fired stations, but possesses considerable advantages in addition. Among the latter may be mentioned the ability, by making use of diversity in demands, to deal with peaks of an extremely fluctuating character, and to utilise a low grade of gas which cannot economically be stored. Such a co-operative scheme is, however, incomplete in one important respect; the amount of gas produced at night and during week-ends is more than can be consumed in the works. In Lorraine a connection is made with the 120-kV transmission system of the State and with a group of Swiss hydro-electric stations, but the chief advantage of the latter connection would be apparent only if large water storage capacity were available.

Interconnection in the iron and steel and coal-producing districts is, of course, no new thing in Great Britain, and, the disposal of surplus energy to a power company has been a recognised practice here for many years. We referred on October 18th, p. 631, to the scheme of the South Yorkshire Coal Owners' Association and its position with regard to the grid, and in last week's issue we gave particulars of the Staveley Coal and Iron Company's up-to-date electrical system, particulars which were amplified during the discussion on the I.E.E. paper. In many cases, however, connections in this country have been made piece-meal and at lower voltages than would have been the case had the schemes originally been designed as a whole, as in Lorraine.

The French system is, nevertheless, deficient in some ways in the light of modern practice, but there is reason to suppose that such deficiencies, which are due to the need for rigid capital economy in the early stages, will be rectified in time. We refer to the use of pin type insulators on super-voltage lines and the lack of selective protection for the overhead lines. Greater operating regularity will no doubt also be secured with the installation of further steam turbines, which will reduce the proportion of the output from the gas engines to some 40 per cent. of the whole, although even this proportion is considered by some engineers to be higher than is consonant with complete reliability. Regard must necessarily be paid to the condition that the production of power at a works must always be a subsidiary operation, and that its cost is usually a small proportion only of the total production cost of the principal commodity. In spite, therefore, of the higher thermal efficiency of the gas engine, its employment is limited to providing a relatively small share of the electrical output.

Our Overseas Markets.

IN this issue we survey the Board of Trade statements with regard to overseas electrical trade in 1928, and once again have to complain of the long delay in their publication.

This analysis of markets is useful. While fluctuations in trade are perhaps mainly due to economic cycles, or to non-recurring causes, the analysis will point in many instances to an adverse tendency which may be arrested; or to opportunities of which fuller advantage may be taken. Where, for instance, there is a decline in imports of a certain class there may be causes susceptible to treatment. It may be due to foreign competition, which can be studied with a view to meeting it effectively; to a change in methods, *e.g.*, a fall in the imports of d.c. machines due to the adoption of a.c., which would seem to point to extra effort in the sale of a.c. plant; to a previous over-supply, which has left a surplus that improved marketing methods might dispose of; or to a number of other influences.

On the other hand, increases in certain directions may be a guide to further opportunities. Large imports of generating plant and cable indicate future business in current-consuming apparatus, for instance. In its wider aspect the analysis shows world trade tendencies and the growing or decreasing value of the various markets. In this connection our survey reveals a number of interesting facts. One of outstanding importance may be remarked upon; at several points a note is made of improved trade with Argentina. It will be seen that during 1928 this customer took larger quantities of British a.c. generators, motors, both a.c. and d.c., radio apparatus, and telegraph and telephone apparatus. In fact for goods of the last class Argentina proved our best

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customer last year. Chile also imported a greater quantity of British telegraph and telephone apparatus. The South American countries as a whole showed a decided improvement. In spite of a general decline in exports of electrical machinery the share of these markets collectively rose in value from £576,961 to £773,797.

The acknowledged supremacy of the British submarine cable manufacturers is confirmed by the fact that our electrical exports to the United States and France consisted very largely of this class of product. Our curves show very clearly the importance of the Dominions to the electrical industry. It is to be observed, however, that while the share of the Dominions fell during 1928, that of foreign countries increased substantially.

Our two most important customers were again Australia and India. The former imported smaller quantities of British electrical machinery and goods and apparatus. India's share of our electrical machinery exports showed a satisfactory increase and she supplanted Australia as the leading importer of this class. Her imports of electrical goods and apparatus remained steady at about £1,500,000. South Africa and New Zealand both failed to reach the 1927 level, but Canada, a small market, showed an improvement.

The growth of the Japanese home industry was further indicated by a large decline in her imports of British goods. On the other hand, Egypt is an expanding market and will probably compensate us for the loss of Japanese custom. The impressions gained from a study of these statistics and by following the curves over the last few years are as follows:—The Empire continues to provide the best outlet for our electrical exports, but there are indications that there must be no relaxation of effort on our part. The Latin-American markets are likely to prove of great advantage to us if they are assiduously cultivated. Exports of electrical goods and apparatus are about double those of machinery in value; and they were maintained in 1928, while for the first time since 1922 machinery exports showed a decline in value although the weight advanced to a small extent.

Possibilities in South America.

SIR MALCOLM ROBERTSON, who recently resigned the position of British Ambassador to the Republic of Argentina, is never tired of stressing the opportunities for British manufacturers and traders in Argentina. His views must carry considerable weight, for during his service as British representative in Buenos Aires he has made a very close study of conditions and kept in intimate touch with Anglo-Argentine trade.

Upon his arrival in this country a week or two ago he again emphasised the need for British traders to concentrate attention upon this important market. He said that Argentina was developing very rapidly and possibilities of trade were increasing. Very cordial friendship existed between the Republic and Great Britain, and it was fully worth the while of those interested in Anglo-Argentine trade to pay a visit of investigation. If they took the trouble to ascertain exactly what Argentina wanted they would have no cause to regret their efforts.

Support for Sir Malcolm's opinion was forthcoming at a dinner given by the Government to South American diplomatic representatives last week. Lord d'Abernon, describing Sir Malcolm as one of the best judges of South American events, said that his optimistic forecast would be fulfilled if negotiations were continued on the broad basis which the British Economic Mission had endeavoured to establish. Lord d'Abernon maintained that it was no infidelity to the Imperial conception to trade with foreign countries. He thought, however, that those foreign countries should reciprocate, even if they had to be warned that failure to do so might mean a diminution in our imports from them.

The speaker also pointed to the esteem in which British character was held by South American countries. Unfortunately, he said, commercial development had not achieved the high level which might have been anticipated from these predilections. Contrasted with future possibilities the present development was only moderate.

This is an endorsement of views which have been expressed frequently in our pages, but we think that reiteration is justifiable and indeed necessary at a time when foreign markets are so essential to the well-being of our industry.

Australian Trade Policy.

FOLLOWING the passing allusion in our last week's leader to the unaccommodating trade policy of Australia and to the detrimental effect upon the industrial interests of the Mother Country, there comes from Melbourne (*The Times*, December 13th) a report that the Australian Association of British Manufacturers has issued a pronouncement expressing deep concern at the effects of the new tariff both on British trade and on Australia's economic and financial position. It protests against the making of drastic alterations without due consideration, and holds that as revised, it is calamitous to many British manufacturers and traders, while its permanent advantage to Australia is questionable. It asserts that our manufacturers are more likely to go to Australia under the old tariff than under the revised one if it be confirmed, and adds that they are now unlikely to pursue the question of opening works there. Unstable policy in Australia does not assist our manufacturers in their efforts to more efficiently meet the needs of the market.

In addition to the protest drawn up in Australia another in the form of a letter has been addressed to the Secretary of State for Dominion Affairs and the President of the Board of Trade on behalf of our Home Association of British Chambers of Commerce. This letter, which is dated December 13th, expresses serious alarm among all engaged in trade between this country and Australia, at the effort which the Tariff will have upon our industries and to our export trade. It is believed that the increases "will have a serious effect on employment in this country. . . . Many trades will be almost prevented from exporting under the new tariffs." Our Government representatives are urged to forward a vigorous protest to the Australian Government, and we hope that in light of such serious warnings they will not fail to do their duty to the workers of these islands.

Low-temperature Heating.

THE use of electricity for providing heat by other means than the luminous radiator is being actively canvassed at the present time. An abstract is published in this issue of a paper recently read by Mr. R. Grierson before the Institution of Heating and Ventilating Engineers, while on Thursday of next week two papers are to be read before the Institution of Electrical Engineers, by Lt.-Col. S. E. Monkhouse and Mr. L. C. Grant and by Mr. T. G. N. Haldane, all dealing with different methods of using electricity to the same end.

Mr. Grierson advocates the low-temperature panel system and emphasises that point that to obtain the best results thermostatic control is necessary. We think that the ease with which electricity lends itself to thermostatic control is likely to become increasingly important among those "incidental" factors which have so often in practice shown electricity to possess advantages of an insufficiently appraised economic value.

Christmas, 1929.

WITH this number of the ELECTRICAL REVIEW we enjoy the privilege of coming a little more humanly into touch with our readers, as we wish them from the bottom of our hearts "A Merry Christmas!" Before our next week's issue appears the Christmas vacation will have passed and we shall be in the midst of everyday electrical affairs again, but to-day we look forward to all those happy, homely, and human experiences which are so welcome to us as a people. As usual let us have a thought for those to whom memory will seem to be unkind, and one for those who stand in need of what we have to give them; also while festive spirits run high in the social circle we will give our "Cheerio!" to the men who are in charge of the electrical and other services which are essential to our common security and enjoyment.

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A Cake and Biscuit Manufactory.

An indication of the extent to which electrically-driven machines and electric ovens are used in a large modern bakery.

CONSIDERABLE interest is attached to the factory in Birmingham whence come the packed cake and biscuits which are so well known in Great Britain and are now in demand overseas also. The business of Alfred Hughes & Sons, Ltd., has always been noted for quality production since its inception nearly 50 years ago, and at the 10-acre factory recently opened at Adderley Park, practically all the ingredients used are produced within the Empire. A large proportion of the sugar used is made from English beet, while all the flour is milled homegrown wheat, and in this connection it is interesting to note that not only are the best biscuits made in this country, but only English flour can be used for making biscuits of high and consistent quality.

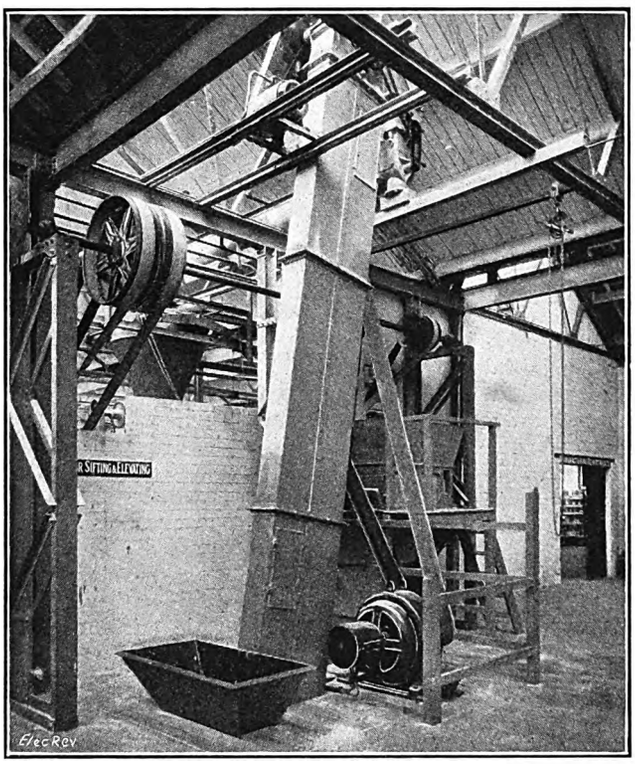

Fig. 1.—Motors driving Flour-sifting and Elevating Plant.

All the machines are driven by electric motors, power being derived from the mains of the Birmingham Corporation at 5,000 volts, three-phase, 25 cycles, and transformed to 440 volts for use in the factory. By utilising the system of individual drive Messrs. Hughes have been aided in their efforts to obtain a bakery of high efficiency, as well as of notable cleanliness, airiness, and comfortable operating conditions generally. Fig. 2 shows a small section of the raw materials preparation department, the motor driving the sugar grinding machine being of 11 h.p. at 1,440 r.p.m. Two other motors in this department are seen in fig. 1, that on the floor being of 35 h.p. at 715 r.p.m., and that on the girders being of 3.5 h.p.; the former drives flour-sifting machines and the latter operates elevating plant. Practically all the motors in the installation under consideration were supplied by the British Thomson-Houston Co., Ltd., whose Birmingham factory is devoted solely to the production of electric motors for industrial requirements. The B.T.-H. starter for the 35-h.p. motor is of the pillar type for floor mounting, a type which is widely favoured in industrial installations on account of the ease of fixing exactly where required and the ready accessibility of all parts for inspection, while the complete system of interlocks and protective features ensures the safety of both the operator and the machine. These equipments can be arranged for control by push buttons if required, and the fact that any number of push-button stations can be provided in the most desirable positions is often of the greatest value.

Of the mixing machines for the ingredients of biscuits the larger are capable of thoroughly incorporating seven to eight cwt. at each mixing. After this process the biscuit dough is passed through a series of "brakes" which roll it into smooth long pieces, which are fed into the cutting and stamping machines, which automatically shape, imprint, pattern and name the biscuits, and deposit them on the baking trays. At no stage in the process is the dough touched by hand, and the loaded trays pass direct to the travelling ovens of a modern type. A chain conveyor takes the trays through the oven chambers at a speed which can be varied to suit the type of biscuit, each oven having a capacity of between 4 and 5 cwt. per hour. On issuing from the mouth of the oven the trays are automatically transferred to conveyors which take them to the packers, sufficient time elapsing for the biscuits to cool before they are taken off by the girls who pack them into tins. In the view of three of the biscuit-making equipments (fig. 4) the protecting covers of the electric motors driving the nearest equipment have been removed. The motors driving the dough brakes are of 10 h.p. at 705 r.p.m., and those of the cutting machines of 8 h.p. at 710 r.p.m. The component machines of each equipment are arranged in line, the entry to the ovens being shown in the illustration. The necessary speed adjustment of the conveyors is obtained by the use of a variable-speed motor in each case.

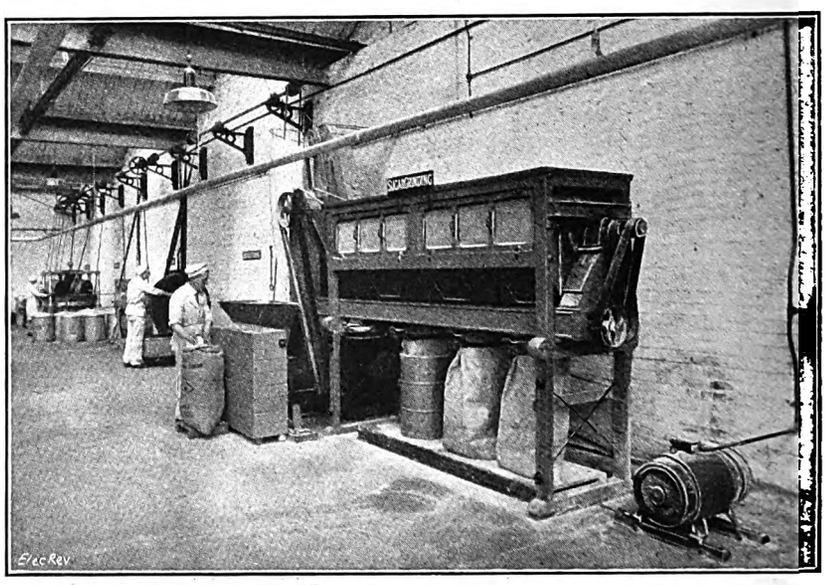

Fig. 2.—Motor of 11 h.p. driving Sugar Mill.

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The two "depositing" machines (fig. 3) are fitted with rollers, so that they can be moved to any position required, and in the illustration both are quite close to the mouth of the oven. The driving motors are of 3 h.p. at 700 r.p.m., and 2 h.p. at 1,410 r.p.m., respectively, being plugged in by flexible cable at suitable plug points.

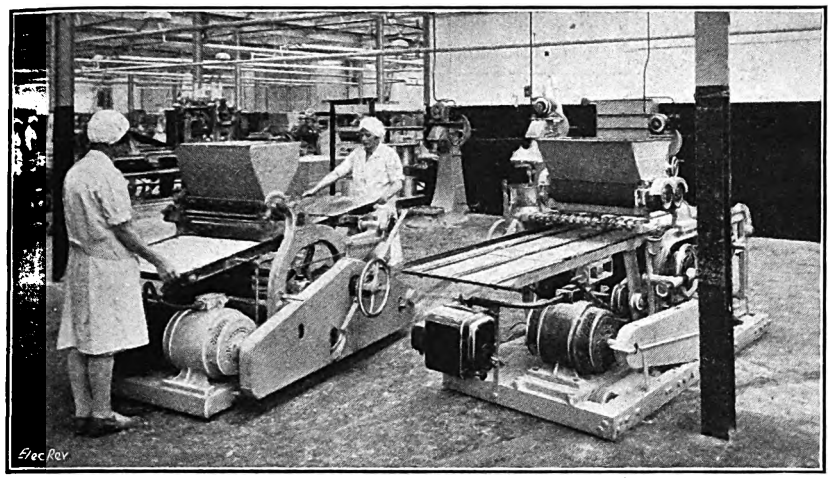

Fig. 3.—Portable Depositing Machines driven by Motors of 3 and 2 h.p.

will be correctly baked. This machine, as well as most of the others referred to, is of Messrs. Baker Perkins make, which firm also supplied the two-tier draw-plate cake ovens illustrated in fig. 5. They are electrically heated and are ideal for cake baking, for which purpose the heat must be easily controlled and maintained at a specific temperature between narrow limits. To this end the heating elements are provided with B.T.-H. automatic control equipment, the desired baking temperature being set by the operator moving an indicator to the corresponding temperature mark on the graduated dial. As soon as the current is switched on, the temperature of the oven rises until the desired limit is reached and is then automatically maintained until the operator alters its value. A special sensitive relay is provided in the control circuits, and when the temperature falls, the temperature-indicator contacts short-circuit a resistance and cause enough current to pass through the relay coil to close the relay, which is in circuit with the operating coil of the contactors for switching the heating elements into or out of circuit. When the relay is closed, the short-circuit is removed from the resistance, and, as soon as the temperature rises, the temperature-indicator contacts short circuit the relay coil, thereby causing the relay con-

Fig. 4.—Dough Brakes, Biscuit-cutting Machines, and Biscuit Ovens.

Several varieties of biscuits require decoration and are transferred from the last conveyor of the oven system to a special section. An interesting machine for coating biscuits with chocolate is that shown in fig. 6, the driving motor being of 2.5 h.p. at 700 r.p.m. While being slowly conveyed through this machine the biscuits are coated with chocolate in viscous form and on emerging from this section they are further decorated, if required, and finally conveyed through a special cooling chamber, the exit of which is in the packing department.

A machine for making ice-wafer biscuits in one operation is shown in fig. 7. It is chain driven by a motor of 3 h.p. at 685 r.p.m. The process is a continuous one, the batter being sprayed on to the bottom sections of hot moulds, on to which the top sections immediately descend, the moulds then passing through the incorporated oven in such a manner that the correct amount of heat is applied to both the top and bottom halves of the mould to ensure that when the wafers are subsequently automatically ejected they

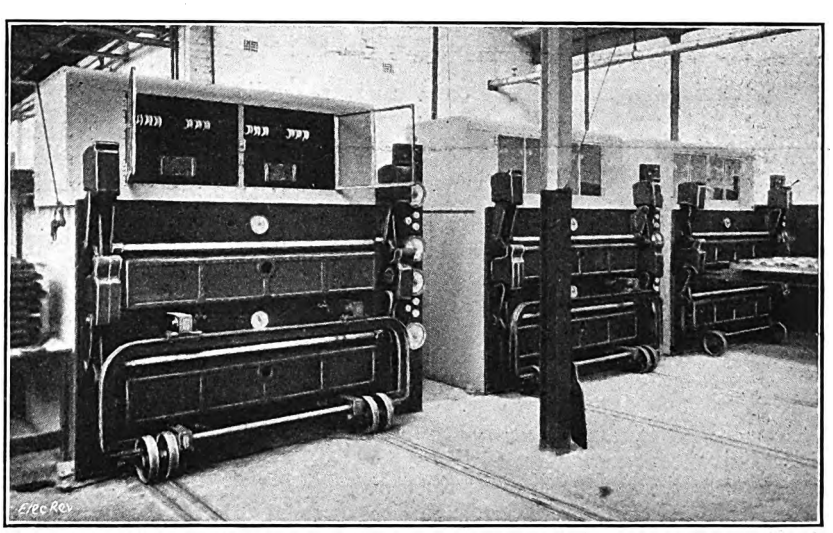

Fig. 5.—Two-tier Draw-plate Cake Ovens with Adjustable Thermostatic Control.

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tacts to open and so make the control equipment ready to go through the same cycle again on a fall in temperature.

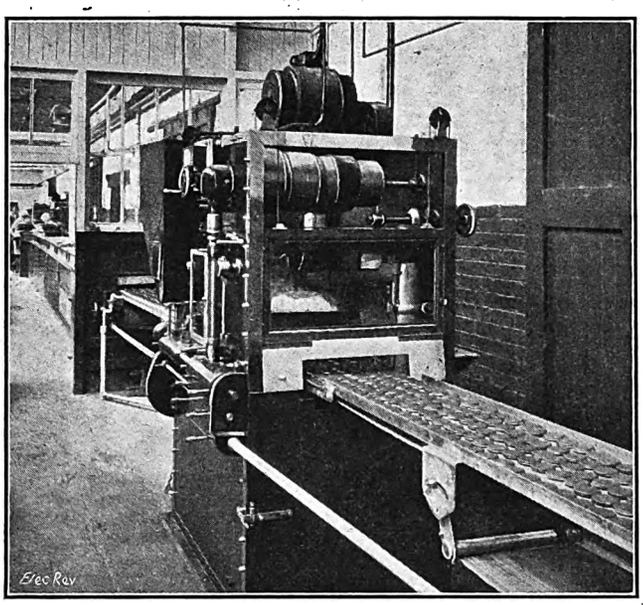

Fig. 6.—Chocolate-coating Machine.

The front glass doors of the contactor box of the oven in the forefront of the illustration are shown opened, so that the relay and contactors can be more clearly seen.

With these ovens Messrs. Hughes are able to obtain remarkable uniformity in baking all kinds of cakes, which, like biscuits, are made from Empire products, mixed by up-to-date electrically-operated plant, and, after baking, hygienically packed. The loss of heat is

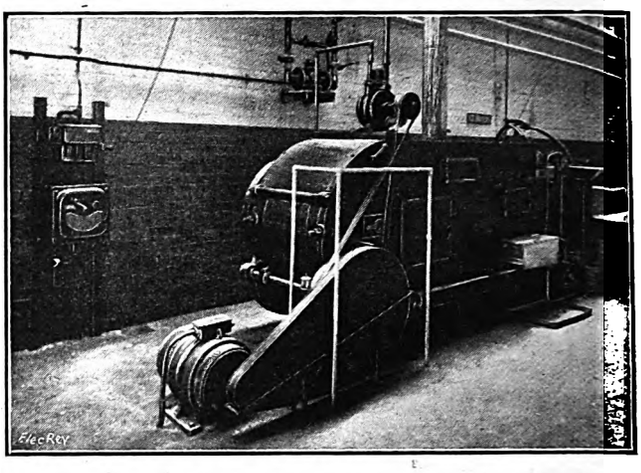

Fig. 7.—Motor driving Ice Wafer Machine, B.T.-H. Starter also shown.

remarkably small and it is said that the ovens will remain almost at baking heat after the current has been switched off for twelve hours.

Sags and Tensions of Overhead Transmission Lines.

A Method of Solving Problems in the Mechanical Design of Overhead Conductors.

By H. SMITH.

THERE are many methods of solving the problems attached to the mechanical design of overhead transmission-line conductors, but very few lend themselves to quick and easy solution, which, for the busy engineer, is essential.

The method to be explained in the following article is really of a well-known form based on the parabola, as will be seen later.

The usual parabolic formulæ are reducible to cubic equations, when either the sag or tension is calculated under the conditions set out by the Electricity Commissioners' Regulations, and it is in relation to the method of solving these equations that the author has considered it worth while to publish his formulæ.

The cubic equation used is built up in the following way, and, to avoid lengthy explanations, it is assumed that the reader is familiar with the derivation of the fundamental formulæ used.

In all problems dealing with the mechanical design of overhead conductors the initial conditions are fixed, and any other conditions of sag, tension, or temperature are determined.

From the parabola the initial conditions for sag and tension are:—

$$T_1 = w\,l^2/8\,s_1 \quad .. \quad .. \quad (1)$$

and

$$L_1 = l + 8/3\,s_1^2/l \quad .. \quad .. \quad (2)$$

The initial conditions in this country are fixed by the Electricity Commissioners, T_1 being one half the breaking load of the conductor, and w being the resultant of wind and weight of an ice loaded conductor, coated with 3/16-in. radial ice in the case of low-voltage lines, and $\frac{3}{8}$-in. radial ice in the case of high-voltage lines, and subjected to a wind load of 8 lb. per square foot on the projected area of the ice-coated conductor; s_1 is the sag under these conditions, l the span, and L_1 the length of conductor.

For any other condition a new set of equations is necessary—

$$T_2 = w\,l^2/8\,s_2 \quad .. \quad .. \quad (3)$$

$$L_2 = l + 8/3\,s_2^2/l \quad .. \quad .. \quad (4)$$

T_2 = new tension, s_2 = new sag, L_2 = new length of conductor, and w = condition of weight of conductor for which the final conditions are calculated.

That is, if the new conditions are for conductors at a higher temperature in still air, w = weight per foot of conductor and, if at a higher temperature under wind load, it is the resultant of wind and weight.

Normally, we wish to find under our final conditions the maximum sag of the conductor, and in this country it is given by the Commissioners as being attained after 100° F. rise in temperature and in still air.

As would be expected, the conductor is elongated due to this rise in temperature, and it follows from the fundamental equations that the tension decreases, and, as the conductor has elastic properties, there will be a decrease in length.

Thus the original length L_1 is increased by $a\,tl$ nearly and decreased by $(T_1 - T_2)\,l/A\,E$ nearly, the assumption being that $l = L$, where a = coefficient of expansion, $t°$ = rise in temperature, A = cross-sectional area, and E = modulus of elasticity. Writing the foregoing in algebraic form—

$$L_1 + a\,t°l - (T_1 - T_2)\,l/A\,E = L_2 \quad .. \quad (5)$$

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Substituting the various equivalents for L_1, T_2, and L_2, we have—

$$l + 8/3\ w^2 l^4/64\ T_1^2 l + a t^\circ l - T_1 l/AE + w l^3/8\ AES_2 = l + 8/3\ S_2^2/l \quad .. \quad .. \quad .. \quad .. \quad (6)$$

This equation contains only one unknown, which is S_2, the sag for final conditions, and is reducible to—

$$S_2^3 - 3\ l^2/8\ (w^2 l^2/24 T_1^2 + a t^\circ - T_1/A\ E)\ S_2 - 3\ w\ l^4/64\ A\ E = 0 \quad .. \quad .. \quad .. \quad (7)$$

Now T_1/AE is the strain in the material or stress/E = m, and equation (7) becomes

$$S_2^3 - 3\ l^2/8\ (w^2 l^2/24\ T_1^2 + a t^\circ - m)\ S_2 - 3\ w\ l^4\ m/64\ T_1 = 0 \quad .. \quad .. \quad .. \quad (8)$$

The solution of this equation is a cumbersome business, but the following mathematical treatment simplifies it considerably.

First, re-write equation (8) as

$$S_2^3 \pm A S_2 - b = 0 \quad .. \quad .. \quad .. \quad (9)$$

the coefficient of S_2 can be either positive or negative.

Taking the positive value first:

then let $S_2 = y - a/3\ y$ .. .. .. (10)

then $y^6 - by^3 - a^3/27 = 0$ .. .. (11)

which is a quadratic in y^3; therefore

$$y^3 = b/2 \pm \sqrt{b^2/4 + a^3/27}$$

from which y can be found and when substituted in (1) gives S_2.

If, on the other hand, we take the negative value of (9)

then $S_2 = y + a/3\ y$ .. .. .. (13)

from which $y^6 - by^3 + a^3/27 - 0$.. .. (14)

and $y^3 = b/2 \pm \sqrt{b^2/4 - a^3/27}$ .. .. (15)

With the aid of the foregoing equations (8) to (15) a simple table can be made of a series of calculations and a form which has been extensively used is shown in Table I, which has been filled in for the sags after a 100° F. rise in temperature for 3/.147 copper stranded conductor for e.h.p. lines.

TABLE I.—SAG CALCULATION.

Conductor: .05 sq. in. h.d. Copper 3/.147 strand.

w = .885 lb. per ft. w = .2 lb./ft. a = 9.222 × 10^{-6}

T_1 = 1,520 lb. m = .001689 t° = 100° F.

$a t^\circ$ = .000922

Item.	Funotion.	l = 200′	300′	400′
a	$-\frac{3}{8} l^2$	− 15,000	− 33,750	− 60,000
b	$w^2 l^2/24 \times T_1^2$	.000564	.001269	.002256
c	$b + a t^\circ - m$	− .000203	.000502	.001489
d	$a \times c$	3.015	− 16.9	− 89
e	$-3\ w\ l^4\ m/64\ T_1$	− 16.7	− 84	− 267
f	$e/2$	− 8.35	− 42	− 133.5
g	f^2	70	1,760	17,800
h	$-(d^3/27)$	− 1.17	17.8	26,600
j	$-f + \sqrt{g} + h$	16.63	84.1	333.5
k	$\sqrt[3]{j}$	2.55	4.38	6 94
n	$k - d/3K = S_2$	2.152	5.67	11.21
p	$T_2 = w\ l^2/8\ S_2$	465	398	184

With the aid of the above table, sag and tension curves can be drawn, and, to enable further tables to be made, Tables II, III, IV, and V are appended, giving the various constants required for h.d. solid and stranded copper conductors, stranded aluminium conductors, and steel-cored aluminium conductors to British Engineering Standards for e.h.p. lines only; that is, the column for w is calculated only for ⅜-in. ice loading.

Table I shows only one application of the method; there are, of course, other conditions of the line which the engineer requires to know, and in all cases means alterations of the values of the constants set out at the top of Table I.

For example, to find the sags at any other temperature, it is only necessary to substitute the temperature rise in t° and modify at° accordingly and then proceed as before. Again, if the "cold sag" or minimum vertical sag is required, that is, when the conductor is at 22° F. with no ice load and no wind, $w = w$, $t^\circ = 0$ and therefore $at^\circ = 0$.

TABLE II.

SOLID COPPER CONDUCTORS ⅜ IN. ICE LOADING.

Area "A."	Weight per ft. w.	Resultant of wind and weight. Ice loaded conductor, W.	Max. working tension, T_1 lb.	$\frac{T}{AE} = m$
.01453	.056	.66	456	.00174
.01629	.0627	.669	508	.001736
.01697	.0654	.673	528	.00173
.01815	.0699	.679	561	.001718
.02061	.0794	.691	633	.0017
.02164	.0834	.696	662	.0017
025	.0959	.713	757	.00168
.02545	.0981	.715	770	.001678
.02688	.1036	.723	810	.00167
.02926	.1128	.734	875	.00166
.03269	.1259	.751	971	.00165
.03731	.1399	.766	1,071	.00164
.05	.1922	.826	1,437	.001595
.0826	.3177	.963	2,244	.00151
.095	.3666	1.030	2,539	.00148
.109	.419	1.072	2,853	.00145
.126	.4843	1.142	3,230	.00142

TABLE III.

H.D. COPPER-STRANDED CONDUCTORS ⅜ IN. ICE LOADING.

Area "A."	Weight per ft. w.	Resultant of wind and weight, W.	Max. working tension, T_1.	$\frac{T_1}{AE} = m$
.025	.1	.752	791	.00176
.05	.2	.885	1,520	.001689
.075	.3	1.001	2,220	.001648
.1	.399	1.062	3,030	.001685
.125	.498	1.194	3,730	.001658
.15	.594	1.301	4,400	.00163
.175	.698	1.415	5,120	.001625
.2	.803	1.53	5,820	.001618
.225	.897	1.622	6,460	.001595
.25	.996	1.74	7,120	.001582
.3	1.215	1.982	8,970	.00166
.4	1.615	2.415	11,700	.001625
.5	2.006	2.84	14,310	.001592
.6	2.368	3.21	17,500	.00162
.75	2.996	3.91	21,750	.00161

TABLE IV.

STRANDED ALUMINIUM CONDUCTORS ⅜ IN. ICE LOADING.

Area "A."	Weight per ft. w.	Resultant of wind and weight, W.	Max. working tension, T_1.	$\frac{T_1}{AE} = m$
.02	.0392	.745	430	.001368
.025	.0491	.776	498	.001268
.03	.0584	.788	593	.001265
.04	.0793	.828	862	.001352
.05	.0976	.866	1,021	.00131
.06	.177	.905	1,184	.00125
.07	.1359	.940	1,368	.00125
.075	.1456	.955	1,464	.00125
.08	.1555	.972	1,533	.00123
.09	.1764	1.012	1,739	.001285
.10	.1963	1.044	1,895	.0012
.125	.2443	1.118	2,310	.001175
.15	.2919	1.195	2,702	.00115
.175	.3446	1.280	3,388	.001225
.20	.396	1.352	3,893	.001225
.225	.4396	1.418	4,235	.0012
.25	.4913	1.486	4,735	.0012
.30	.597	1.635	5,578	.001165
.35	.692	1.760	6,396	.001155
.40	.794	1.890	7,182	.001113
.45	.9006	2.030	8,304	.001155
.50	.9806	2.132	9,042	.001155
.60	1.163	2.360	10,401	.001115
.75	1.474	2.740	12,902	.00109

TABLE V.

STRANDED STEEL CORE ALUMINIUM ⅜ IN. ICE LOADING.

Area "A."	Weight per ft. w.	Resultant of wind and weight, W.	Max. working tension, T_1.	$\frac{T_1}{AE} = m$
.025	.0726	.784	1,090	.00181
.03	.0864	.810	1,273	.00178
.04	.115	.864	1,704	.001775
.05	.145	.914	2,053	.001715
.06	.173	.960	2,443	.001715
.07	.205	1.012	2,793	.00165
.075	.215	1.026	2,937	.00165
.08	.229	1.045	3,030	.001605
.09	.260	1.080	3,409	.0016
.1	.268	1.119	3,693	.001675
.125	.335	1.220	4,567	.00166
.15	.491	1.394	7,619	.001875
.175	.571	1.495	8,861	.001875
.2	.675	1.610	10,197	.001875
.225	.737	1.708	11,262	.00184
.25	.822	1.810	12,358	.00182
.30	1.006	2.040	15,118	.00182
.35	1.163	2.212	16,762	.00174
.40	1.332	2.42	18,536	.00168
.45	1.478	2.60	20,393	.00166
.50	1.347	2.495	18,165	.00164
.60	1.611	2.808	20,940	.001585
.75	2.015	3.272	25,519	.00154

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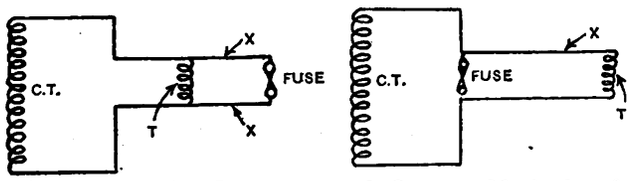
Some Distribution Troubles.

Faults Commonly Occurring on High- and Low-Voltage Networks.

By THOS. BARTON, B.Sc., A.M.I.E.E.

ALTHOUGH alternating current is coming to the fore as a means of distributing electricity, yet there are many d.c. supplies still in existence. A 3-wire d.c. supply is a general means of distribution, yet one of the troubles particularly peculiar to this means of supply is due to electric osmose.

Take the case of an underground sub-station in which the slate panels with the attendant fuses &c., mounted on



Figs. 1 and 2.—Incorrect and Correct Methods of Connecting Fuses.

angle or flat iron framework, are insulated at the base by porcelain insulators from, say, a glazed brick plinth. It will be observed some short while after installation that verdigris has collected on the base of the panel to which the negative main is connected. On touching the slate panels by hand one obtains an appreciable shock —an indication that the verdigris has caused considerable leakage. The glazed brick plinth also will be found to be considerably damp. The whole of the panels may be cleaned up, but the action still goes on—verdigris again develops.

In a three-wire system, the neutral being earthed, the negative is below earth potential. The electron leakage current therefore flows from the negative to earth. Whilst this stream of free electrons flows from negative to positive, displacement of collected H_2O apparently flows from positive to negative and, when it comes in conjunction with the copper and brass connections, causes verdigris. It should be noted, however, that this verdigris collects only on the base of the panel, where the latter is insulated from the brick plinth; at the top of the panel, where insulation occurs from a long angle iron, the effect is hardly noticeable.

A further trouble also applicable to a d.c. system is that of electrolysis. Here the cable which becomes positive with respect to earth suffers most. Consider

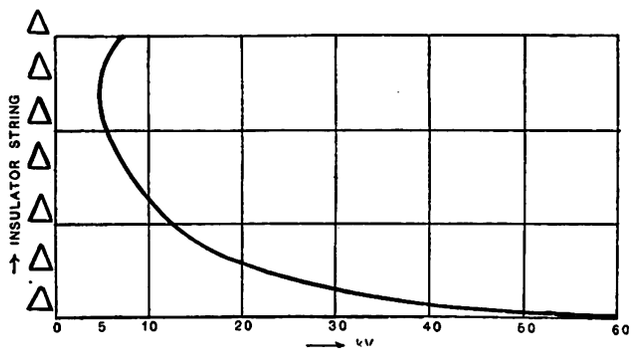


Fig. 3.—Potential Gradient for Sound Insulator String.

a paper lead-covered cable laid in ducts into an underground sub-station where water slowly trickles down the ducts. The electron leakage stream in the positive cable occurs from the water *via* the lead and paper, respectively, to the positive conductor. This leakage current, although initially small yet flowing constantly in the same direction, starts electrolytic action. The result is that the lead surface gradually takes up a white incrustation of lead carbonate; the lead sheath slowly thins until the water enters the papers, and finally the cable breaks down.

Consider next the case of an a.c. sub-station with six independent low-voltage feeders. The low-voltage side of the transformer is controlled by an automatic oil switch with C.T.-operated overload trip coils set at 5 amperes, but are also time limit fused. The six feeders are each controlled by porcelain handle type fuses in the phases with a link for the neutral.

Inadvertently, a nail is driven by a consumer through one of the six-feeder cables and the sub-station is shut down. Examination at the sub-station shows that none of the six-feeder fuses in any phase have blown—neither have the time limit fuses—consequently, until the offender admits his fault, one cannot diagnose on which phase or feeder the fault has developed.

Strictly speaking, the fuses in the feeder circuit should have blown. What actually has happened is that, due to the time lag of the feeder fuses (the time limit fuses being ineffective as stated below), the switch has operated on instantaneous overload. Time limit fuses become somewhat ineffective when connected up as fig. 1. Fig. 2 is the correct method of connection.

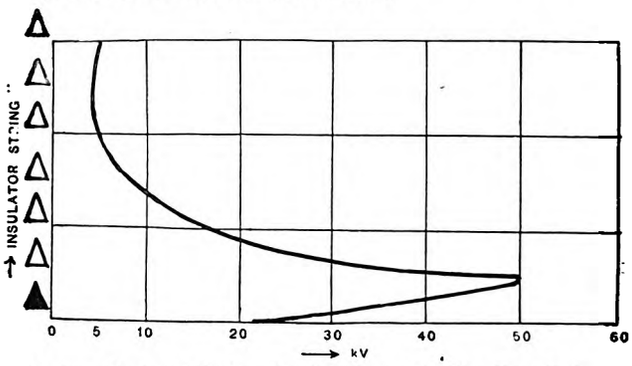


Fig. 4.—Potential Gradient when Faulty Insulator is at Earthed End.

It will be seen from fig. 1 that, if the resistance of the leads x, plus the resistance of the fuse contacts, plus the resistance of the fuse wire, is large compared to the impedance of the trip coil T, then the trip coil will operate before the time limit fuse blows. This fault arises through having long leads from the current transformer (CT) to the time limit fuse. The fuse contacts, too, should also be kept clean.

A trouble which arises due to paper lead-covered cables laid up a hill is that of compound running. This generally happens when, due to overloading of the cable in question, the impregnating compound becomes less viscous and slowly runs down hill, leaving the paper somewhat dry at the hill top. The cable then loses its flexibility and there is a tendency to crack the papers when a slight bend is required, with consequent breakdown of the cable.

This question of compound running, or bleeding, becomes more serious in super-voltage cables than in low-voltage cables. There are in general two methods of making up a paper-insulated cable. The first is to impregnate the papers and then wrap them on the conductor under compound, whilst the second method is to wrap the papers on the conductor first and then to vacuum-impregnate them. The former method enables a

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more viscous compound to be used, and, consequently, bleeding starts at a higher temperature. The latter method necessitates a less viscous compound, and, consequently, its advantage is flexibility. Bleeding, however, should be avoided, as on super-voltage cables it causes the scattered air in the cable to collect in one location and form a void. At super-voltages the air in the void ionises and finally causes a breakdown of the cable.

Consider now the overhead transmission line. If we have a string of seven suspension insulators and, due to a surge or pressure rise, one of the seven breaks down, the line is not necessarily put out of action. Failure may be due to an insulator which, although having an initial puncture, might yet " heal up " and withstand a certain voltage again.

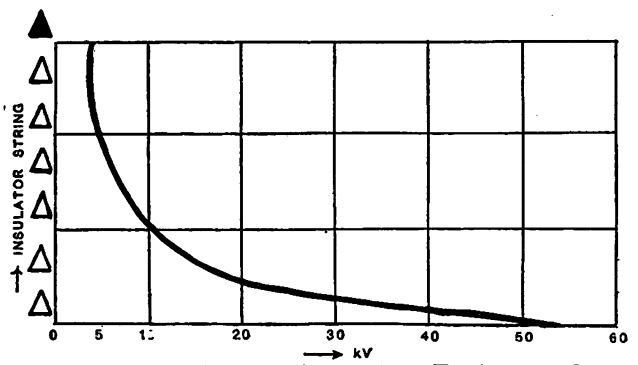

Fig. 5.—Potential Gradient when Faulty Insulator is Next to the Line.

The potential gradient is shown in fig. 3 for a sound string of insulators, whilst fig. 5 shows the faulty insulator located next to the line—the effect being to throw the stress upon that insulator next above the faulty one in the string.

The effect of a faulty insulator in the middle of the line is shown in fig. 6, and in fig. 4 the faulty insulator is located at the earthed end of the string. In all cases the line pressure was maintained at 100 kV and the gradient obtained by measuring the voltage across each insulator in turn.

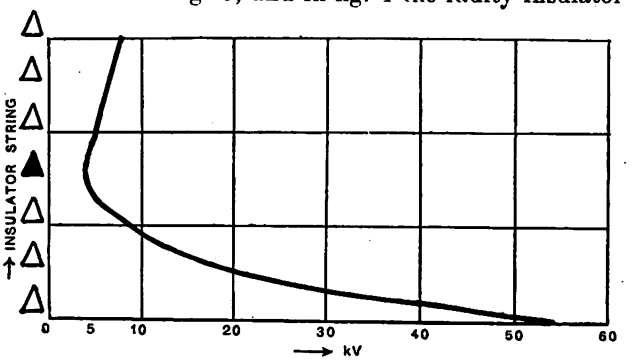

Fig. 6.—Potential Gradient when Faulty Insulator is in Middle of the String.

The Insurance of Employés.

A Large Electrical Company's Non-Contributory Scheme.

By BASIL BARHAM.

SOMETHING of an innovation in engineering works practice was made by one of the largest electrical manufacturing companies in existence some little time ago. It formulated, and put into practice a group life insurance plan for all its employés, including those engaged in different localities in erecting its manufactures and those employed in its branch and district offices. This insurance scheme applied to everyone in the employ of the company, no matter what their age, sex, or physical condition might be, and it appears that the plan has now been operating for a sufficient time to enable it to be said that it is a complete success.

Many of the benefits of works insurance will be obvious, but there is one which might be overlooked and which has a great bearing upon the relations between the firm and its workpeople and also upon production. This is the fact that every employé has his mind relieved as to the danger of financial trouble coming to his family in the event of his death. It may be urged that, to some extent, an insurance plan has a weakness here, in that it relieves the employé of any incentive to save and make provision for his dependants. It does not seem, however, as though the scheme referred to has that effect in practice. Another benefit which is felt entirely by the company and which, in itself, is worth some expenditure to obtain, is that the plan secures a marked degree of continuous service. We heard recently of the tendency of workpeople to change their situations for no apparent reason, and an instance was given of a man who had been in four or five different works in as many months. A man will, however, think twice before he leaves a works in which he is insured for a fairly large sum to go to his family in the event of death from any cause.

The amount of the insurance effected on the workpeople is £100 for one year's service, £150 for two, £200 for three, £250 for four and £300—which is the maximum—for five years' service. It appears that the life insurance company with which the policies have been arranged has waived the physical examination of the employé as a condition of the insurance, which is provided at the expense of the company. When the plan was more or less in an experimental state, the initial policies were for one year, but the success was such that some other arrangement will now be made. A question arose as to differentiation between those employés who had families and those who, in the event of death, would leave no dependants, and as a result it was decided that the latter should be insured for a nominal sum of £30, which would cover funeral expenses. Here, again, would appear to be a question of policy, bearing in mind that continuity of employment is to the advantage of the employer. The migratory habit is chiefly noticeable amongst unmarried employés, and the fact that an unmarried man is only insured for £30, as against £100 and upwards for a man with dependants, seems to place a premium on getting married and settling down. Naturally, the insurance ceases with regard to any employé when he leaves the service of the company, but an arrangement has been made with the insurance company by which insurance on a standard policy form at ordinary rates may be taken up by a man leaving his job, without any physical examination.

The company carrying out the plan has, roughly, 23,000 employés in one works, of whom over 10,000 have been regularly engaged for five years or over and so come within the scope of the maximum insurance. Of the remainder the great majority have already completed three years' service.

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Our Foreign Electrical Trade.

The Origins of Imports and Destinations of Exports, with Figures for 1928 and Previous Years Compared.

THE annual statements of the overseas trade of the United Kingdom for 1928 have now made their somewhat belated appearance. They supplement the rather meagre information given in the monthly returns by furnishing, under a much more detailed classification, particulars of the countries of origin and destination, respectively, of imports and exports.

It may first be recalled that imports of machinery and of goods and apparatus in 1928 showed an advance in value in each of the two groups, the respective increases compared with 1927 being £126,000 and £455,000. On the other side of the account, exports of machinery showed an advance in weight of 396 tons, but a decrease in value of £7,000, thus breaking what had been a continuous rise in value for at least nine years, while exports of goods and apparatus decreased by the small sum of £250,000, this decline being spread fairly evenly throughout the whole group, although shipments of unspecified electrical goods and apparatus showed an advance of £200,000. The net result was a favourable

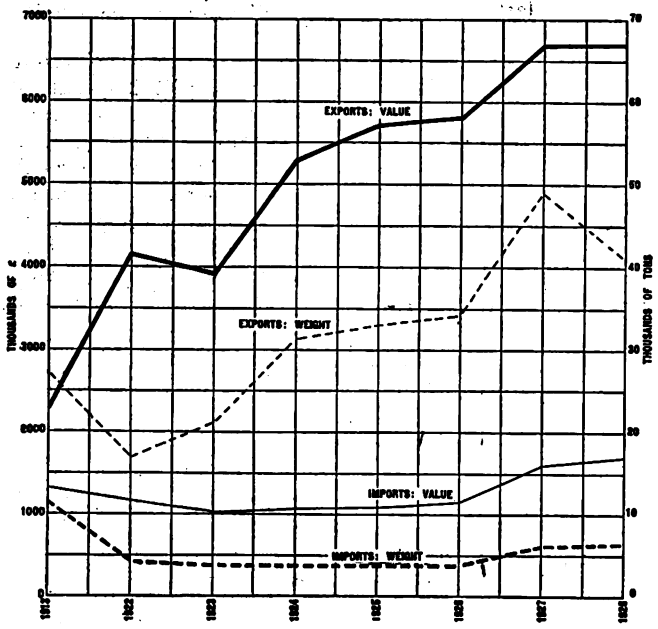

Fig. 1.—Imports and Exports of Electrical Machinery.

balance in the electrical trade generally of £11,900,000, only slightly less than in the previous year.

The general tendency over the past few years is shown graphically in figs. 1 and 2, the latter indicating at the same time the proportion of the total value of electrical goods and apparatus taken by British countries. It will be noticed that this proportion has shown a decline for three years running. Among foreign customers (other than those shown on charts 4 and 5) which helped to compensate for this decline, the United States is notable with purchases totalling £481,000 in value (largely submarine cable), Italy with £355,500, France with £250,000, Holland with £242,000 and Chile with £206,000. With regard to the trade in electrical machinery, it is found that the export of traction motors was lower than for at least five years, the total being £475,191, as compared with £495,159 in 1927, Empire markets having been accountable for the decline. South Africa's great activity in the traction field, which resulted in purchases between 1924 and 1927 averaging £150,000 yearly, seems to have come to a halt, for her total in 1928 was only £6,250. On the other hand, India's figure was £139,134, or twice the average of the previous four years. Japan was a better customer again with £67,000 against an average of under £40,000 during the previous six years. The trend of the traction motor trade over a period of years is illustrated in fig. 3,

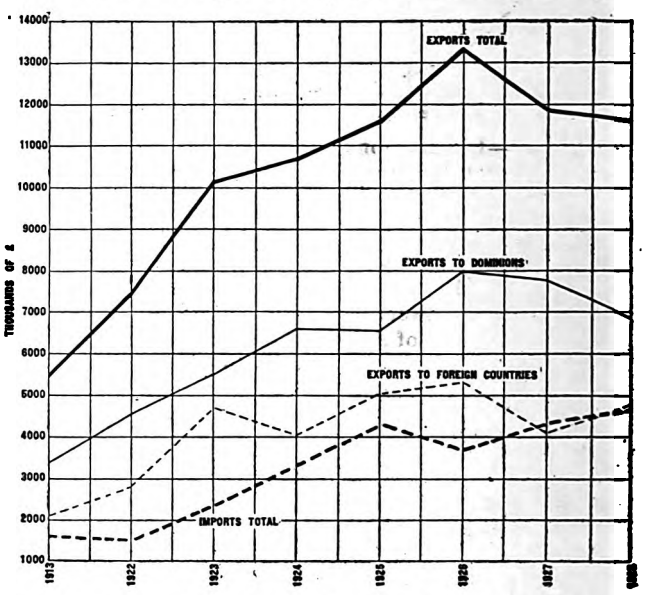

Fig. 2.—Imports and Exports of Electrical Goods and Apparatus.

on which are also shown the curves of lamp exports and imports.

While exports of a.c. motors were well maintained on the whole, this was due to foreign purchases (£304,786 against £190,183) and not to trade within the Empire, exports to the latter being only £474,102 as compared with £598,169 the previous year. Australia and the

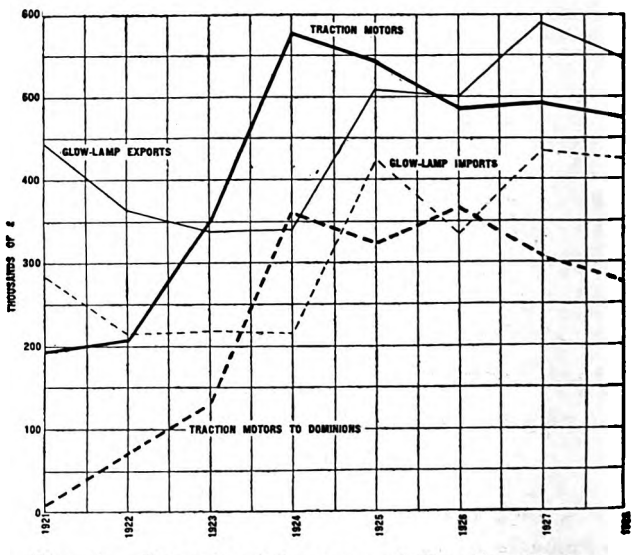

Fig. 3.—Exports of Lamps and Traction Motors.

Straits Settlements were the only Empire destinations for which a decline was not registered. To Argentina the value sent last year was £66,200, as against £22,860 in 1927. Exports of these motors to foreign destinations were in fact higher in value than in any year since 1921, although even in that "boom" year the weight was less than in 1928.

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There was again a decline in the Empire's purchases of d.c. motors, *viz.*, to £257,606, from £472,000 in 1927 and £520,000 in 1926, small advances to Canada and the Straits Settlements being the only exceptions. There was also a decline on balance in the foreign trade, the Argentine Republic being a notable exception.

Of a.c. generators the total value exported (£847,000) was higher than ever recorded and nearly £300,000 above

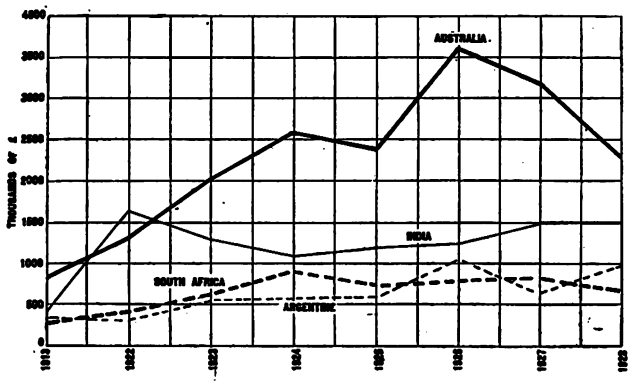

Fig. 4.—Destinations of Electrical Goods and Apparatus Exports.

the average of the previous six years. Among noteworthy items were exports to Russia (£67,000) and Argentina (£74,000). Empire trade was fairly well maintained, a noteworthy item being £69,000 to Canada, against an average of £33,000 only for the previous four years. Our trade in d.c. generators remained steady with regard to both value and destination.

In converting and transforming plant our export progress was only fairly well maintained. Nevertheless, of rotary plant, shipments last year reached £302,000, against £411,500 in value in 1927, whereas six years ago they were valued at less than £150,000. For static transformers the figure was £584,000, or about the same as in 1927, against only £259,000 in 1923. It is rather unsatisfactory to find, on the other hand, that imports of convertors and transformers rose last year to £153,000, as compared with only £43,000 in 1927. Exports of "electrical machinery not elsewhere specified" reached the high value of £1,113,000, or about the same as in 1927. Of the grand total of exports of electrical machinery, *viz.*, £6,690,000, the value consigned to British countries was £4,390,000, and that to foreign destinations £2,300,000, thus following the recent trend,

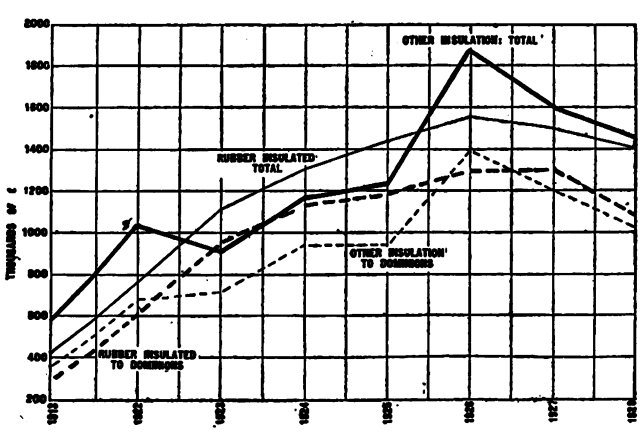

Fig. 6.—Exports of Cable (not Telegraph or Telephone).

for in 1926 and 1927 the Empire was more than twice as valuable a customer as the rest of the world. Its relative share in the electrical goods and apparatus trade is shown in fig. 2, as already pointed out. Although there was but a small decrease in the total value of the exports of electrical goods and apparatus, there was a loss of trade with British countries amounting to £966,000, as compared with 1927. The British Empire was still far and away a more important buyer as a whole than foreign countries of lamps, batteries, and accumulators, lighting accessories, instruments, and all descriptions of cables, except submarine, but not of radio and other telephone and telegraph apparatus.

Looking further into the destination of our export trade in goods and apparatus, it is found that compared with 1927, Argentina has been a more active purchaser of telegraph and telephone apparatus; Chile of telegraph and telephone material and radio instruments; France of submarine cables, radio instruments, and

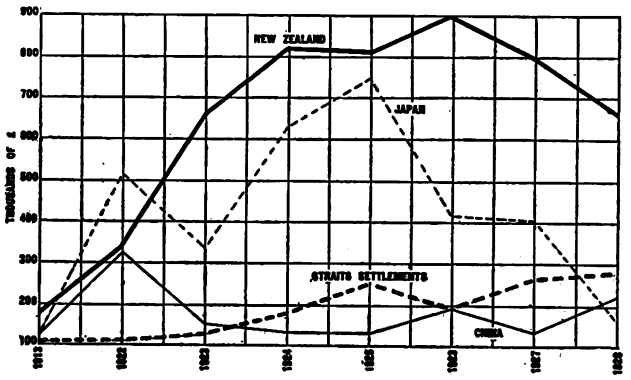

Fig. 5.—Destinations of Electrical Goods and Apparatus Exports.

lighting fittings; and Italy of telegraph and telephone apparatus and also of a large quantity of material under the heading "unspecified." The Egyptian market continues to grow. It is noteworthy that Japanese trade suffered a further decline, the total value of her purchases of electrical goods and apparatus being but £161,000 last year, as compared with an average for the four preceding years of £550,000.

Figs. 6 and 7 show how exports in the cable group have progressed. They account for over 35 per cent. of the total exports of electrical material other than machinery. Of rubber-insulated cable, other than telegraph and telephone, about one third of the value which was sent to British countries again went to Australia, and the same remark applies to cable (not telegraph or telephone) with insulation other than rubber. There was a fairly large shipment (£390,000) in 1928 of submarine cable to the United States, while for telegraph

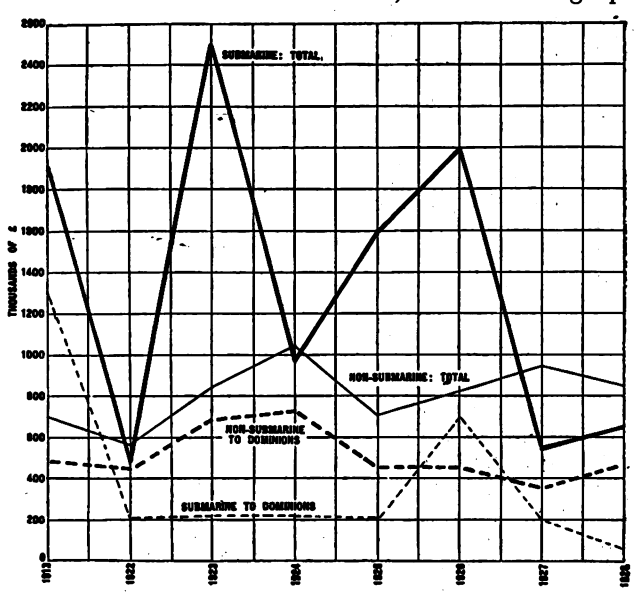

Fig. 7.—Exports of Telegraph and Telephone Cable.

and telephone cable, other than submarine, Egypt and South America figured as large customers, although the Empire accounted for nearly half the trade.

Overseas business in radio apparatus has been barely maintained. Exports of such material (not including valves) reached £950,000 in value in 1928, as compared with £1,000,546 in 1927 and about £100,000 more than that figure in the two preceding years. The main destinations of this material were:—British countries £335,000 (including Australia, £95,000, India, £58,000, South Africa, £43,000, and Irish Free State £39,000),

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and foreign countries £614,000 (including Holland, £109,000, France, £73,000, Japan, £38,000, and Argentina, £25,000). Of other telegraph and telephone instruments Australia again figured largely as a purchaser with £400,000, but was excelled by Argentina with £426,000 (against £211,000 in the previous year). On the whole the British group showed a distinct falling-off, which was balanced by a rise from £648,000 in 1927, to £943,000 in 1928 in the foreign trade. Exports of radio valves have been checked, the value last year having been only £180,000, as compared with £213,000 in 1927, with Australia the best customer (£56,000) and then South Africa (£14,500).

The chief countries from which our imports of electrical goods and apparatus and machinery are derived are shown, respectively, in figs. 8 and 9. Reckoning goods and apparatus as well as machinery, Germany's

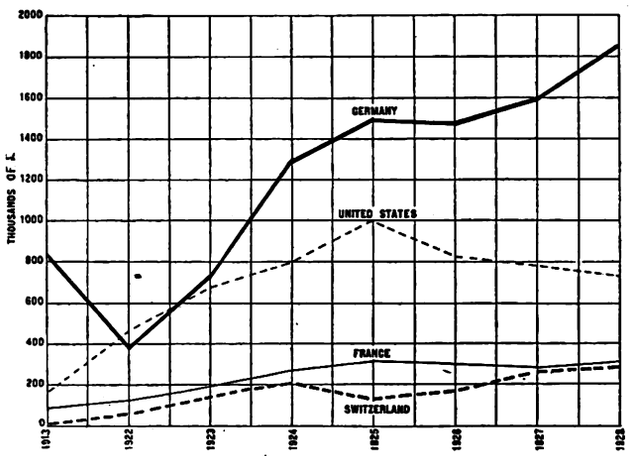

Fig. 8.—Origin of Electrical Goods and Apparatus Imports.

total contribution to our imports was £2,034,000, as compared with £1,802,000 in 1927; that of the United States £1,409,000, as against £1,427,000; that of Switzerland £364,000, and that of Sweden £275,000. With regard to d.c. motors, which, apart from vacuum cleaners, still constitute the largest item specified amongst imports of electrical machinery, there was a small decrease from £210,400 in 1927 to £182,000 in 1928. The bulk of these machines again came from the United States (£124,000, against £144,000); Germany's share was valued at £18,000 (against £15,000), while Sweden, Holland, Belgium, Switzerland and France made contributions valued at between £5,000 and £7,000.

Imports of a.c. motors were also rather less in both value and weight than in 1927, *viz.*, 995 tons valued at £147,600, against 1,065 tons valued at £162,800 in 1927, but it should be recalled that in the preceding year only 583 tons valued at £88,000 were imported. Of the 1928 total, £71,500 is credited to the United States, £44,000 to Sweden, and £11,000 (against £8,000 in 1927) to Germany.

In the import trade in generators there was an increase on the whole. Of a.c. machines, it is true, the value was only £11,900 against £16,900 in the previous year and no less than £64,500 in 1926, but of d.c. generators there was a greater value (£54,000) imported than in any year since 1922, and a greater weight than ever before recorded. The United States accounted for £20,761, and Switzerland £19,880.

Imports of vacuum cleaners, for which a new heading in the trade returns was raised in 1927, had a total value

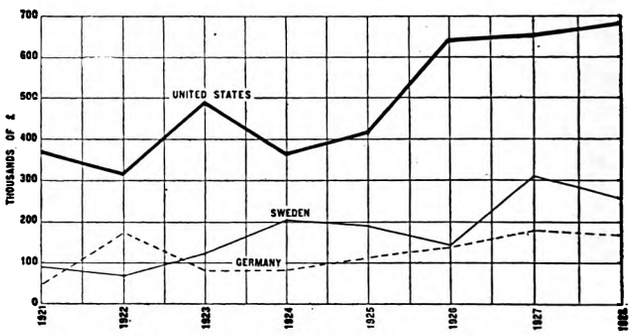

Fig. 9.—Origin of Electrical Machinery Imports.

of £656,000, including £114,000 from Sweden, £176,000 from the United States, and £232,000 from Canada. Our exports of vacuum cleaners are comparatively negligible—£32,000 last year, compared with £43,000 in 1927. In the goods and apparatus group there were particularly noteworthy increases in lighting accessories (including switches) and fittings, and batteries, an advance of about £140,000 being shown in the former group.

The Barton Judgment.

The author reviews the circumstances of the recent Farnworth *versus* Manchester Corporation action, sets out the reasons for the decision of the House of Lords, and comments on an existing anomaly.

By J. W. THOMAS, LL.B., B.Sc., A.M.I.E.E.

IT is not easy to condense into a small compass the main points of the judgment of the House of Lords in the recent case of Farnworth *v.* Manchester Corporation,* but it is desirable that some attempt should be made for the benefit of supply engineers who are naturally very much interested in it. There were really three points to be decided, two of them matters of law and the other a matter of fact: (1) Was the Manchester Corporation Act, 1914, which authorised the Corporation to acquire land and erect the Barton generating station a special Act within the meaning of the Electric Lighting (Clauses) Act, 1899? (2) If not a special Act did the Act exempt the Corporation from liability for nuisance provided there was no negligence? (3) Assuming that the Corporation had such statutory immunity from liability for nuisance had it in doing what the Legislature had authorised done all that was reasonably necessary in order to avoid a nuisance?

It may be noted that if the answer to the first question had been in the affirmative or the answer to the second question in the negative it would have settled the matter, as the nuisance having been admitted the Corporation would have been liable. The determination of these legal questions depended upon what was the true construction of the 1914 Act, and that they were by no means free from difficulty, is quite clear from a perusal of the judgment. In order to understand the issues involved it is desirable to give a short account of previous legislation and of the law with regard to nuisance.

Prior to 1899 it was customary to insert in every Provisional Order entitling an undertaker to supply electricity in a certain area a clause to the effect that "nothing in this Order shall exonerate the undertakers from any indictment, action, or other proceedings for nuisance in the event of any nuisance being caused or permitted by them." This clause has since become

* ELEC. REV., December 6th, p. 1023.

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known as the Nuisance Clause, and the effect of its inclusion is to render the undertaker liable to proceedings for any nuisance caused in carrying on an undertaking.

The Manchester Order of 1890, which is the foundation of the Corporation's electricity supply powers, contains a nuisance clause, and thus the Corporation is liable for nuisance even though caused without negligence in the management of the stations within its area of supply. In other words, its liability for nuisance is precisely that under the common law, and it is only necessary to prove that the nuisance exists for liability to arise. The fact that a station has been built under the authority of Parliament and that it is worked without negligence (if that be the case) does not when there is a nuisance clause in the Act or Order relieve an undertaker from paying compensation for damage in the event of a nuisance arising. It may be explained at this point that a public body is no more authorised to create a nuisance, unless compensation is provided, than a private body. There are cases, however, such as with the railways, in which statutory powers are granted to bodies to create a nuisance without being liable provided that they can prove that the nuisance is necessarily incidental to the carrying on of their activities. A body has only this authority, however, when the language in the statute from which it derives its powers is sufficiently clear to authorise the nuisance. Where, on the other hand, the Act definitely provides that the body shall not be exonerated from liability for nuisance it is in the same position as any private body under the common law.

As Provisional Orders became more frequent it was thought desirable to group the usual clauses into one Act and provide that they should be incorporated in every subsequent Provisional Order or Special Act unless expressly excluded or varied. Accordingly, in 1899 the Electric Lighting (Clauses) Act was passed, and it enacted that the provisions contained in the schedule to that Act should be incorporated with, and form part of, every Provisional Order and Special Act made after the commencement of the Act save in so far as they were expressly varied or excepted by the Order or Act. The term "Special Act" was defined in the 1899 Act as "any Act passed after the commencement of this Act authorising the supply of electricity for any public or private purpose within any area." Amongst the provisions in the schedule was the nuisance clause. Thus in every Provisional Order and Special Act made since the 1899 Act the nuisance clause has been deemed to be incorporated unless expressly excluded or varied. Subsequent Acts have not changed this procedure as they are to be construed together. The Electric Lighting Act of 1909 provided that the Board of Trade (now the Electricity Commissioners) could by Provisional Order authorise any local authority, company, or person to acquire compulsorily and to use for the purpose of a generating station any land specified in the Order within or without the area of supply. Since the passing of that Act many undertakers have obtained special statutory powers by Private Act authorising them to acquire land and to erect and work generating stations. The nuisance clause has been expressly excluded from some of these Acts, thus making the undertakers liable only to proceedings for nuisance in respect of such stations in the event of negligence being proved against them. If the nuisance clause is incorporated, as it sometimes is, then they are liable for nuisance caused without negligence. Assuming that the clause is neither incorporated nor expressly excluded the question whether the undertaker is liable for nuisance without negligence will depend upon whether the particular Act is to be regarded as a Special Act within the meaning of the Electric Lighting (Clauses) Act, 1899. This was the first point to be decided in the Barton case. The powers to acquire the land and to erect the station at Barton were obtained by the Manchester Corporation Act, 1914. This was an "omnibus" Act which conferred other powers on the Corporation. The main purport and effect of the Act so far as it related to the generation of electricity was to empower the Corporation to acquire compulsorily a site outside its area of supply for the purposes of a generating station, to erect and work a station on that site and to construct and maintain the necessary mains to enable the electricity generated to be brought into the area of supply. Opinion was divided both in the Court of Appeal and in the House of Lords as to whether the Act conformed with the definition of a Special Act contained in the Clauses Act, 1899, but a majority in both held that it did not. In deciding that the Act was not a special one Viscount Sumner and Lord Blanesburgh expressed the view that the Act was not one authorising the supply of electricity within any area because the Corporation by previous Provisional Orders already had been authorised to supply in its area. Lord Dunedin, however, differed from this opinion, and pointed out the dangers that were likely to arise if this view were adopted. It would mean that municipalities knowing the law would avoid Provisional Orders when arranging for a generating station outside their own boundaries and endeavour to get their authority in an "omnibus" Act which would not be a Special Act containing a nuisance clause. Thus they would avoid the liabilities which a nuisance clause would otherwise impose upon them. By getting evidence to prove that they knew of no remedy to prevent the nuisance undertakers could practically throw the onus of finding one on the plaintiff. If they were under a nuisance clause they would have to exert themselves to find a remedy, and the onus of proving that there was none would be upon them. So far as the Manchester Corporation was concerned, had the portions in the 1914 Act relating to the Barton generating station been embodied in a Provisional Order, instead of being in an "omnibus" Act, the nuisance clause would no doubt have been incorporated and the Corporation would then have been made liable to the same extent in respect of Barton as it was in respect of its other generating stations.

Having ruled by a majority that the 1914 Act was not a Special Act, the next point for determination was whether it was the intention of the Legislature under the Act to take away the common law rights of individuals who might be injuriously affected by the working of the station. It is well known that the Legislature has frequently invested public undertakings with powers the exercise of which, although interfering with the private rights of individuals, are of advantage to the general public. Such an intention to take away those rights, however, will not be imputed to the Legislature, and the burden lies upon those who seek to establish such an intention to show that it appears either by express words or by necessary implication. In one class of case the powers conferred by statute are of a purely permissive character and only authorise the doing of a thing provided it can be done without interfering with the private rights of individuals. In the other class there is an intention to interfere with private rights but with the proviso that if the interference can be avoided by a reasonable exercise of the statutory powers it is actionable negligence on the part of the undertaker not to make such a reasonable exercise. The law with regard to this class was laid down by Lord Blackburn in the case of Geddis in which he said that "it is now thoroughly well established that no action will lie for doing that which the Legislature has authorised if it be done without negligence although it does occasion damage to anyone." The House of Lords decided in favour of the proposition that the Barton station fell within the second class. Had the contrary view prevailed the Corporation would have been held liable seeing that nuisance had been admitted. The next point therefore for their Lordships' consideration was whether the Corporation had used all due and reasonable means and precautions to avoid a nuisance. It is significant that their Lordships were unanimous in finding that the Corporation had not proved that the nuisance was necessarily indispensable to the running of the station. Like the Court of Appeal they were not satisfied that all reasonable steps had been taken to explore the causes of, and remedies for, the damage or that all reasonable precautions had been adopted to prevent it. They therefore confirmed the decision of the Court of Appeal and awarded damages to the plaintiff, but agreed that the suspension of the injunction should continue for one year from the date of the Order of the House. During the next twelve

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months, therefore, the Corporation will have an opportunity of exhausting all reasonable modes of preventing the nuisance, and will be at liberty to apply to the King's Bench Division to dissolve the injunction on establishing that it has done so and that it is replacing the existing methods by the most effective method which it has discovered. The criterion as laid down by Lord Dunedin is "not what is theoretically possible, but what is possible according to the state of scientific knowledge at the time, having also in view a certain commonsense appreciation, which cannot be rigidly defined, of practical feasibility in view of situation and expense."

There can be no doubt that the effect of the Barton decision will be to stimulate the efforts which are now being made to deal with the emission of sulphur fumes. Whilst few are likely to agree with the strictures passed on the Corporation for what was described as its callous indifference in the construction of the station, one must admit that the question of liability for nuisance has not been treated by engineers with the seriousness which it deserves. The issue raised is obviously a grave one from the point of view of those who are affected by the sulphur nuisance, and they are entitled to demand either some compensation for the damage done or the satisfaction of knowing that everything possible has been done to prevent it.

But if engineers are open to criticism, the lawyers are in no better plight. They are responsible, at least to some extent, for the present confused and uncertain state of the law. To the layman it must seem illogical that there should be such uncertainty with regard to the liability for nuisance and that some power stations which happen to have been erected under private Acts should enjoy certain advantages as to liability for nuisance whilst others erected under a Provisional Order do not. If generating stations are to be authorised by Parliament they should be put upon the same basis as far as their statutory powers are concerned, and if one might venture to suggest it, it should be similar to that of the railways, so as to subject them to no more liability than is laid down in the case of Geddis.

The Barton case will have served a useful purpose if it directs attention to the desirability of the Legislature, when granting powers under private Acts, of stating in express and uniform terms the extent of the liability for nuisance incurred in the exercise of them.

Electricity for the Home.

Examples of All-electric Houses; Descriptive Notes and Cost Data.

A Demonstration All-Electric House.

A feature of the business-getting programme adopted by the WEST GLOUCESTERSHIRE POWER CO., LTD., for domestic electrification is a demonstration all-electric house, the following particulars and illustrations, figs. 1 and 2, of which we have received from Mr. Harry Ellis, M.I.E.E., the general manager and chief engineer of the company. Some idea of how the purpose of the installation is being fulfilled may be gathered from the fact that during the months of September and October last 500 people visited the house.

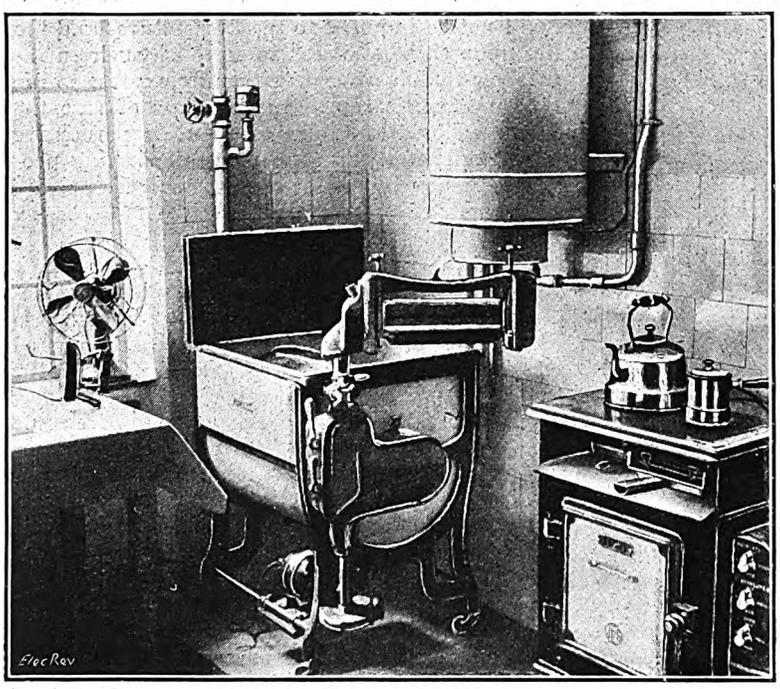

Fig. 1.—The W. Gloucestershire Co.'s All-electric Kitchen.

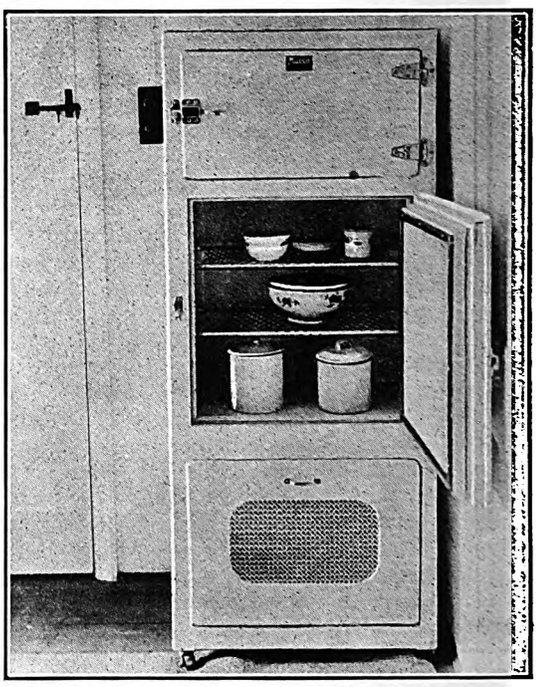

Fig. 2.—A "Marco" Refrigerator.

The house is one of average size, and has three bedrooms, two reception rooms, and a kitchen and bathroom. It is fully equipped throughout with electrical apparatus for lighting, heating, cooking and water heating, and there are many auxiliary appliances. The dining room is equipped with a "Goodwood" central lighting fitting (Gregson Mfg. Co.), a G.E.C. table lamp and shade, a 1-kW Belling radiator, a Metro-Vick coffee percolator, a Premier warming plate, and a Metro-Vick toaster. Two 5-A outlets serve this apartment. Heating in the sitting room is provided by a 3-kW "Magicoal" fire (Berry's Electric), while light is provided by a totally-enclosed central unit and a standard lamp, both of Metro-Vick manufacture. A "Premier" electric kettle, a M.V. vacuum cleaner, and a G.E.C. all-mains radio set constitute the remainder of the electrical equipment in this room, in which there are four outlets.

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A very comprehensive range of electrical appliances is in use in the kitchen, a view of which is depicted in fig. 1. The cooker is of the "Jackson" No. 20B type, with the oven-interior, racks, and panelled door vitreously enamelled. The kettle (3¼-pints) is fitted with a safety device and is of Jackson manufacture, as also are the 10-gal. storage heater and a 10-gal. wash boiler, which is fitted with three-heat control and a "Perco" wash device. The "Magnet" washing machine, with "Wizard" attachments, and a "Locomotive" washer are both demonstrated at different periods. A "Marco" No. 159 refrigerator, fig. 2, and a "Frigidaire" No. D.5 model are also shown alternatively. The lighting is provided by a M.V. central ceiling fitting, and the heating by a 1-kW G.E.C. radiator. A further essential kitchen utensil is an "Xcel" electric iron. A M.V. oscillating fan is of special interest in that it is governed by a "Satchwell" thermostat in order to demonstrate this method of control. The bedrooms are fully equipped electrically; each has a two-light rise and fall lighting pendant over the dressing table, and mirror brackets; "Litlux" bed lights and a table lamp are also on show. A 1-kW, a 750-W, and 600-W (bowl fire) radiators serve for heating the three bedrooms.

The entrance, hall, landing and bathroom are all artistically lighted, and the hall is equipped with "Unity" tubular heaters.

The demonstration described was arranged by the Company's Sales Department, under the direction of Mr. Parker (sales engineer) and Mr. Reynolds (consumers' engineer).

Stoke-on-Trent.

The residential areas of the City of Stoke-on-Trent and the surrounding pottery towns are essentially working class districts, and the Corporation's efforts to popularise the domestic use of electricity are therefore of considerable interest.

The main features of the Corporation's scheme for the domestic development of electricity are all-electric houses, a low multi-part tariff, showrooms, and a wide range of publicity matter attractively written.

Realising that to increase the domestic consumption of electricity it was necessary in the first place to teach the residents the many uses to which it can be applied, the Corporation, early in 1927, adopted the practical method of opening eight all-electric houses for public inspection, and later in the same year these were let to tenants, who have since expressed their great appreciation of the convenience of electricity. Four of these houses have one fire place and chimney each, but the others depend entirely upon electricity for all domestic purposes. The record of consumption and cost of electrical energy in these houses over a period of two years provides an excellent example of the cheapness of electricity in the area when used for all purposes. During the first year of tenancy, the total consumption in the eight houses was as follows:—Lighting, 1,279 kWh; radiators and cooking, 35,522 kWh; water heating, 23,879 kWh: total, 60,680 kWh. The total cost was £203, the average cost per house per week 9s. 8d., and the average cost per kWh 0.80d. For the second year the figures were even more favourable, the total consumption increasing to 71,174 kWh, largely due to the increased use of radiators and cookers, whilst the total cost was reduced to £189, or an average per house per week of 9s. 1d. and an average cost per kWh of 0.64d. These houses proved so successful that another eight were inaugurated in October last. In addition to the figures given above, those supplied by Mr. C. H. Yeaman, city electrical engineer, relating to his own house are interesting. For the year ended with the last September quarter the total consumption was 12,365 kWh at a total cost of £30 16s. 4d., and an average price per kWh of 0.508d.

The foregoing results have been obtained by the operation of the following attractive multipart tariff: a fixed quarterly charge (which includes meter rent) of 5s. per living room, and a consumption charge of 1d. per kWh for the first 240 kWh per quarter, and ⅜d. per kWh for all electricity consumed in excess of that amount.

Full advantage is taken of the electricity showrooms to propagate the electrical idea and, in addition to frequent demonstrations, the local branches of the E.A.W. and the E.C.A. hold their meetings on the premises. Cordial relations are maintained with the local electrical contractors by handing over to them a portion of the difference between the trade and retail prices of domestic appliances sold from the showrooms.

When to these activities the holding of electrical exhibitions is added, it will be seen that not only does the Corporation offer electricity for domestic use at a price within the reach of the working man, but it also ensures that the advantages to be derived from its use are constantly before the eyes of prospective consumers.

Fig. 3.—Stoke Corporation's All-Electric Houses.

Electricity, Gas, and Coal Costs.

The following particulars which we have received from Mr. Eustace R. Conder, A.M.I.E.E., of Liverpool, will no doubt be useful and of interest, as the case is probably typical of the majority of electrical domestic consumers at present, in that electricity and coal are both used:—

"In response to your request in your leader of October 4th for 'reliable information as to the actual costs in respect of all-electric houses,' I have pleasure in enclosing tabulated costs for my own house during the past four years. Previous to September 30th, 1927, I used coal fires in the kitchen and living room, and gas for lighting and cooking, and a gas fire in a room which is used during part of the day as an office. This gas fire could not be used in any other room. As from September 30th, 1927, I have used coal fires in the kitchen and living room, and electricity for lighting and cooking, and a 3-kW radiator in the room which is used during part of the day as an office. This radiator has been sometimes used in other rooms.

"My household consists of my wife and three children, ages 18, 20 and 25 years, respectively, and myself."

The costs referred to are as follows:—

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Tabulated Costs.

Year ended September 30th, 1926 :—

	£	s.	d.
184.3 therms at 8d.	6	2	11
Gas meter rent		2	8
Gas cooker rent		6	0
Total cost of gas	6	11	7
Coal	11	11	8
Total cost of gas and coal	£18	3	3

Note.—This included the period of the coal strike when economy was exercised in the use of coal and gas.

Year ended September 30th, 1927 :—

	£	s.	d.
218 therms at 9d.	8	2	10
Gas meter rent		2	8
Gas cooker rent		6	0
Total cost of gas	8	11	6
Coal	12	11	5
Total cost of gas and coal	£21	2	11

Note.—After the coal strike the cost of gas was increased.

Year ended September 30th, 1928 :—

	£	s.	d.
1,594 units at 0.5d. per unit ...	3	6	6
20 per cent. of £21 ratable value	4	4	0
Electricity consumed cost 1.13d. per unit	7	10	6
Electricity meter rent		10	0
Electric cooker rent	1	0	0
Total cost of electricity	9	0	6
Coal	12	0	0
Total cost of electricity and coal ...	£21	0	6

Year ended September 30th, 1929 :—

	£	s.	d.
1,703 units at 0.5d. per unit ...	3	11	0
20 per cent. of £22 ratable value	4	8	0
Electricity consumed cost 1.12d. per unit	7	19	0
Electricity meter rent		10	0
Electric cooker rent	1	0	0
Total cost of electricity	9	9	0
Coal	10	2	9
Total cost of electricity and coal ...	£19	11	9

Note.—The ratable value was increased to £22. The 3-kW radiator and an additional 1½-kW radiator were used during the evenings of spring and autumn instead of coal fires. Hence the increased consumption of electricity and decreased consumption of coal.

Collieries and the Grid.

In a recent discussion at the Sheffield University on electricity and collieries, Prof. Douglas criticised the grid system, under which, he said, colliery owners would be at a serious disadvantage by having to take their supplies for power purposes from the super-stations of the Central Electricity Board, whereas by making their own they could ensure cheaper supplies. Mr. Wm. Hay, managing director of the Thorncliffe Collieries, declared that the grid system would seriously increase the cost of electricity to colliery companies, and it could not be expected that those responsible for working collieries would consent to a system which would compel them to pay more for their electricity. While at the present time they were prevented from using their surplus power, they were expected to turn over that surplus to the super-power stations, who would reap a profit from such surplus and use the power in any way they wished.

Reviews.

Elements of Electrical Engineering. Second edition. By Arthur L. Cook, B.S., M.S. Pp. xi+584; figs. 379. London: Chapman & Hall, Ltd. Price 20s. net.

This book has been thoroughly revised for the second edition to incorporate an account of the developments which have taken place in the electrical industry since its first appearance in 1924. A new chapter on the electron tube has been added, and the sections of the work dealing with d.c. machines and rectifying apparatus have been considerably amplified. A new set of problems has been substituted for those in the first edition.

The book is intended to outline an elementary course in electrical engineering for junior students and also for those specialising in other branches of engineering. A knowledge of the rudiments of electricity and magnetism is assumed, as well as an acquaintance with elementary mathematics. The mathematics in the book are generally very simple, and the calculus does not appear to be used at all. Although the work is generally concerned with elementary electrical engineering theory, there is a fair amount of descriptive matter illustrative of the principles treated. As this descriptive matter relates to current American practice, its value to the English student is somewhat discounted.

The first portion of the book deals with electric and magnet circuits, and here the principles of direct current working and of electromagnetic relations are dealt with in the conventional manner. A chapter in this section deals simply with electrostatic principles.

A considerable space is devoted in Part II to direct-current machinery. The construction, operation and characteristics of dynamos are dealt with in considerable machinery, and the author has evidently been at pains to make clear to his readers the principles underlying the actions of the machines of this class. His explanation of the building up of the voltage of a self-excited machine would, however, have been much clearer had the well-known graphical construction of resistance lines intersecting the saturation curve been utilised. The characteristics of d.c. motors are explained in considerable detail, and there are in this part useful chapters on commutation of armature reaction and the determination of the efficiency of d.c. machinery, starting gear, and three-wire balancing machines. A short chapter is devoted to storage batteries, and the concluding chapter in this part deals with d.c. distributing systems and wiring installations.

The third part of the book deals with the principles of alternating currents and with calculations relating thereto. Here, again, we have the detailed and careful treatment which should be useful to the student of non-mathematical tastes who is commencing to work on this subject. There is little novelty in the author's methods, but it is somewhat surprising to see how little reference is made to the subject of power factor which usually looms large in works of this character. We have in this part a very clear account of the phase relationships of current and voltage in polyphase circuits. There are a few references to a.c. instruments in this part, but this apparatus is only briefly noticed in passing, and there is no separate chapter or section devoted to it.

The concluding part of the book deals with a.c. machinery, and considers, in order, transformers, induction motors, synchronous generators, motors and convertors. The chapter on the induction motor would have been considerably clearer had the elementary form of the circle diagram been used for the purpose of illustration. The chapters on current rectifiers and single-phase motors are too scanty to be of much use, whilst, in the chapter on switching and protective devices there is not, as would be expected, any reference to the systems of automatic protection which now plays so important a part in alternating current engineering. The treatment of a.c. transmission lines is brief, but useful, whilst the notes on illumination and lighting fittings and on the application of d.c. and a.c. motors will be acceptable to the student.

The book is provided with a good index, and there is an extensive collection of problems for solution. The utility of this collection is, we consider, much impaired by the fact that the answers to the numerical examples are not given. The work is, however, generally conventional in character and differs very little from the numerous books on the elements of electricity which have been published in America in recent years. Whilst it will probably be useful to those who are not specialising in electrical engineering, it can hardly be considered as an ideal textbook for those intending to make a serious study of this subject.

Elements of Radio Communication. By John H. Morecroft. Pp. x+269; figs. 170. London: Chapman & Hall, Ltd. Price 15s. net.

Mr. Morecroft's large textbook on the "Principles of Radio Communication" is in extensive use as a standard treatise in the United States and is well-known to students and radio engineers in this country, so much so that a new book by this author is bound to be received with interest in both countries.

The present book, however, is intended for the use of students, as opposed to those who are already versed in the

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subject; in fact, the scope of the book is admirably summed up in the first word of its title, the "Elements." It may be considered as an introductory volume to the more ambitious "Principles," which has already been reviewed in this journal, and the general scheme followed is the same, *viz.*, a review of the general theory of alternating currents, followed by the applications of this theory to the art of radio communication, with, however, special emphasis on its applications to broadcasting, one whole chapter out of seven being devoted to broadcast receiving sets. The book, in fact, is more an introduction to radio broadcast practice than to radio communication in its wider sense, and this is specifically implied in the preface, where the author mentions that "a large proportion of students are naturally interested in broadcasting." Many of such students will obviously have only an elementary knowledge of mathematics, and the author is careful to avoid anything more advanced than simple algebraic formulæ.

The subject is dealt with accurately and concisely, but, in covering so much ground in so small a space, a student who is trying to understand the subject without outside assistance is certain to find that difficulties arise from the matter appearing at times to be disjointed. With the help of an instructor these difficulties would disappear, and the book would be found to form a sound introduction to the theory and practice of radio communication. A set of problems is given for each chapter, and this should prove of great value to the student.

Very little is said about commercial radio practice, but many aspects of broadcasting in the United States are mentioned which will interest people on this side, such as the fact that advertisers may pay as much as 5,000 dollars an hour for the use of a station, as well as paying for the artists engaged. The historical aspect is not touched upon, but in this connection we are surprised to see that the name of the inventor of the audion is always spelt Deforest.

The whole production of the book is first-class, including what is often overlooked, the placing of diagrams exactly where the text requires them for easy reference.

Electromagnetic Problems in Electrical Engineering. By B. HAGUE. Pp. xiv+359; figs. 116. London: Oxford University Press, (Humphrey Milford). Price 30s. net.

It has been our privilege on other occasions to review earlier works by Dr. Hague, and in so doing to play no small part in introducing to electrical students and engineers the investigations of one of our most brilliant workers in the field of pure and applied electricity and magnetism. The present volume adds to our indebtedness to the author, and it constitutes an exceptionally able and orderly treatment of essentially basic theories, and, in spite of its relatively modest compass, we think Dr. Hague's book will undoubtedly rank as a classic on the subject. The work is concerned with the investigation of the magnetic field in simple types of dynamo-electric machines and allied apparatus, including transformers, and, being addressed to two distinct classes of reader, is divided into two corresponding parts. The first, which deals with the general theory of the subject of electromagnetism, is designed, as might be supposed, for the use of advanced students of electrical engineering and others who require an elementary discussion of the principles of electromagnetism so far as they bear upon the physical theory of electrical machinery and apparatus. While attention is directed to scalar potential and flux conceptions, the idea of vector potential has also been introduced, and the need for this method of treatment in connection with electromagnetic problems is indicated, its properties being also demonstrated in a way designed to appeal to engineers. In the chapter on mechanical forces on linear conductors the author gives a particularly interesting comparison of the method usually adopted for calculating the forces of currents in the magnetic field with Maxwell's ether stress theory. The second part is offered as a link between the ordinary textbooks of electricity and magnetism and those which discuss the design and operation of electrical machinery chiefly from the practical engineering standpoint. Thus Part II chiefly appeals to practicing design engineers. In this part the principles enumerated in the theories embodied in Part I are applied to the calculation of certain practical engineering problems. Particular attention is directed to the work of Rogowski and of Roth on the leakage field in transformers, and to Strutt's solution for the magnetic field of thick conductors with various forms of cross section.

Chapter I is a general introduction to the subject. Chapter II has for its basis a study of the elementary physical theory and definitions of the electric field of a current. Chapter III deals with the elementary mathematical theory of the magnetic field of a current which embraces geometrical properties of potential and curl fields, two dimensional electromagnetic fields in free space and within a conductor, vector potential and boundary conditions in the electromagnetic field. Chapter IV discusses the general theory of electromagnetic fields with iron boundaries and the method of images. The general theory of the mechanical forces on linear conductors is established in Chapter V, which covers considerations of mechanical force on a circuit and Maxwell's theory of the force on a circuit.

The second part of the book, which deals with the applications of the principles laid down in the foregoing chapters, opens in Chapter VI with a treatment of the magnetic field of linear currents or of current sheets in an air gap with plane iron boundaries when the iron has infinite permeability. Chapter VII deals with electromagnetic forces on linear conductors in an air gap with plane iron boundaries when the iron has finite permeability. Chapter VIII discusses the magnetic field of linear currents or current sheets in an air gap with concentric circular cylindrical iron boundaries of infinite permeability.

In Chapter IX the author passes on to the logical treatment of the electromagnetic force on linear conductors in an air gap with concentric circular cylindrical iron boundaries of infinite permeability. Chapter X passes on to the general case of which Chapter VIII was a particular example. Chapter XI derives the general expressions for the electromagnetic force in non-salient pole machines, and Chapter XII deals with the magnetic field of straight conductors having various shapes of cross sections, and it also contains a very interesting summary of the methods of treatment of the leakage field in shell type and core type transformers, having cylindrical and sandwich windings. The treatment is based largely upon those of Rogowski and Roth.

Chapter XIII, which is the last in the book, deals with the mechanical forces on simple circuits and within conductors. The volume is completed by appendices on the method of drawing the field distribution diagrams and the representation of electromagnetic fields by solid models.

The author presupposes the reader to possess a good general knowledge of electricity and magnetism, a thorough familiarity with the principles of electrical engineering, a fair knowledge of differential and integral calculus, an understanding of the use of Fourier's series, and an elementary acquaintance with the simpler parts of vector analysis. We hardly think a work requiring such a standard of mental equipment can accurately be described as elementary, and no doubt the author's own technical attainments have given him a somewhat mistaken sense of relative values in this direction. Thus, while there may be a considerable number of students and engineers who will agree with the author's classification of the volume, the large majority, we feel, will regard it as occupying a much more exalted sphere.

It will be gathered from what has been said that the book deals principally with rotating electrical machinery, and in this connection we invite the author's future consideration of a more extensive treatment of the electromagnetic phenomena arising in transformers and kindred static apparatus, such as induction regulators and iron-cored choking coils. May we hope this is foreshadowed by the reference in the preface to a future work on the complete theory of electromagnetic machinery which will embody the graphical and experimental methods of dealing with field distribution problems mentioned by the author?

The book is admirably produced in a style which leaves nothing to be desired, while the illustrations are excellent. The price charged for the volume, while high, is not unduly so for the standard of the contents and of the production.

S. Austen Stigant.

Electric Street Lighting. By C. J. STAHL. Pp. xi+288; figs. 128. London: Chapman & Hall, Ltd. Price 17s. 6d.

Most of the up-to-date literature on this subject is contained in the journals of scientific societies, and a practical book dealing with Electric Street Lighting represents a valuable contribution to the book shelves of those engaged in administering public services.

The author writes with the authority of many years practical experience in the subject, and, while its presentation has the exclusive background of American experience, there is much in the volume that can be put into practice by street lighting engineers in this country.

The author has not attempted (who can?) to give dogmatic prescriptions for street lighting design based upon absolute scientific procedure, but he has given empirical rules which represent a compromise of the many important factors involved in street lighting to ensure general satisfaction.

He follows usual American practice in giving lumens per linear foot of street, pointing out that horizontal illumination alone is not the only important factor of good street lighting, and that this can be said of almost any application of light.

The chapters dealing with city zoning for street lighting, circuit arrangements including series lighting, and architectural aspects of street lighting are particularly thoughtful and valuable. Some of the illustrations of decorative street lighting units used in other countries should form valuable examples to civic authorities in this country.

The chapters dealing with "Light, Cause, and Effect," "Light Measurement," and "Principles of Light Control" attempt to deal in a short space with matters that are already sufficiently well covered in other manuals, and in any further edition one would suggest that this section be revised or eliminated.

There is also evidence of careless editing, as it is difficult to refer to tables mentioned in the text. This is particularly true on page 222.

To summarise: the book is, on the whole, well produced and represents an important contribution to the subject.

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Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

The "Electrical Review" Index.

The Index to Vol. CV (for the half year ending December 31st, 1929) will be published shortly, and we shall be glad to receive the names and addresses of those who require it (free of charge) for binding purposes or wish to retain it for reference. Application should be made as early as possible to the Publisher, 4, Ludgate Hill, E.C.

Electrical Trades Commercial Travellers' Association.

A successful dinner and dance of the Electrical Trades Commercial Travellers' Association was held at the Hotel Cecil on December 11th. The chairman of the Association, Mr. R. W. Whitley, presided over a gathering of about 170 members and guests. In a brief speech—the only one of the evening—Mr. Whitley extended a warm welcome to the guests and thanked the members for their excellent support of the function. A bouquet of pink carnations was presented to Mrs. Whitley. Almost everyone took part in the dancing which followed the dinner, while an interlude of community singing was heartily enjoyed. A set of lancers was received with an enthusiasm in no way marred by a somewhat imperfect knowledge of the steps. Mr. J. W. Ward is to be congratulated on carrying out so efficiently the arrangements for the evening.

An Echo of the General Strike.

In our last issue we reported the dismissal from the Hull Tramways Department of a number of men who joined the Department during the general strike of 1926. The matter was raised in the House of Commons on December 12th by Sir A. L. Ward a Hull member, who asked the Minister of Labour what action she proposed to take. Miss Bondfield replied that the matter was solely one for the decision of the City Council. Sir Arthur Steel-Maitland asked if she would not get into touch with the parties concerned in order to remedy any victimisation. Miss Bondfield asked for notice of the question.

It is reported that the men involved are raising a lefence fund to enable them to fight the case.

Electricity in Refrigeration.

Mr. R. C. Hawkins, Area Officer of the British Electrical Development Association, gave an address on December 10th to members of the North-Western branch of the British Association of Refrigeration at Liverpool on the electric lighting of cold stores. Some interesting points were raised in the discussion. Commander Owen said that in the wiring of cold chambers trouble had been experienced owing to the condensation that took place. Lead-covered cable had been used alternatively to conduit, but in that case oxidisation was liable to take place, leaving a crumbling mass of white lead and creating the danger of short circuits. Many tests had been made at cold stores of different methods of wiring and eventually a simple form of vulcanised rubber covered cable had been proved satisfactory.

The Demand for Factory Accommodation.

In a recent letter, Messrs. LEOPOLD FARMER & SONS, surveyors, auctioneers and valuers, 46, Gresham Street, E.C.2 state:—"The year 1929 has proved in many ways an extraordinary and, for some periods, a difficult one. At the beginning business was as flourishing as in the year 1928. New industrial companies were being formed, combines of existing businesses were taking place, and factory premises throughout the country were being keenly sought after. With the advent of the General Election, however, business began to drop away. New public issues practically ceased, and manufacturers were biding their time before seeking new or additional factories. Subsequently, what with one disastrous event after another in the financial world, business became somewhat restricted. At the same time there appears now to be a revival of interest in the manufacturing world with regard to the acquisition of premises. Prices of factories have remained practically the same as in the year 1928, and there is very little diminution in value where a factory is of modern construction. In fact, there appears to be a special demand, which is difficult to meet, for this class of factory. Where no such property is available there is a tendency for manufacturers to build to their own requirements, and there are many areas within a radius of 30 or 40 miles of London, where considerable building operations are taking place for the erection of factories, embracing all the modern requirements of the up-to-date manufacturer. During the course of the year our Valuation Department has been kept very busy; at all times valuations of assets are necessary for various purposes.

"One of the great legislative features of this year, and for which manufacturers are particularly thankful, is the De-Rating Bill. It has given relief to the producer which in many instances was much needed. It has assisted him in reducing to a great extent his overhead charges, and provided additional working capital for the greater employment of labour and a larger output of the finished product. It has also had the effect of producing a demand for factories in neighbourhoods that have been neglected, in consequence of the high rates peculiar to the district, so that from everybody's point of view this excellent piece of legislation meets with well merited thanks and unstinted appreciation."

The British Exhibition in Buenos Aires.

We are informed that the Prince of Wales has agreed to become patron of the British Empire Trade Exhibition, which is to be held in Buenos Aires from February 18th to April 2nd, 1931. A booklet is now available from the London office of the Exhibition, 5, Parliament Mansions, Orchard Street, S.W.1. (Telephone: Victoria 0877), giving full particulars of the arrangements. The charges for space and stands are set out, and it is emphasised that no profit is to be made from the Exhibition by the organisers. Other matters dealt with are: Services and supplies, Customs, shipping, lighting and power, retail sales, and representation. An architect's drawing which is reproduced promises a very large, well-laid-out display. There are also key plans of the ten pavilions.

Our Foreign Electrical Trade.

The following were the values of imports and exports of electrical goods and machinery during November:—

	Nov., 1929. £	Inc. or dec. as compared with Nov. 1928. £	Eleven months, 1929. Inc. or dec. £
Imports.			
Electrical goods & apparatus	736,482	+212,687	+1,542,068
Machinery	1,531,320	+109,721	+2,012,069
(Including electrical machinery)	161,190	+ 25,202	+ 129,426
Exports.			
Electrical goods & apparatus	1,252,933	+255,576	+1,296,852
Machinery	5,078,911	+427,925	+ 700,591
(Including electrical machinery)	574,115	– 78,125	– 372,211
Re-exports.			
Electrical goods & apparatus	25,141	+ 6,033	+ 46,212
Machinery	143,286	+ 734	+ 5,661
(Including electrical machinery)	13,390	– 4,928	– 21,431

The American General Electric in Styria.

According to the *Grazer Tageblatt*, the General Electric Company of America will participate in the exploitation of the beryl deposits recently discovered near Koeflach, in Styria, and will spend $1,000,000 for the purpose. It is also reported that the company's works in Dakota will be abandoned, as the Koeflach Beryl Works are sufficient for the requirements of the whole world.—*Reuter* (Vienna).

Calendars and Diaries.

The 1930 calendar sent us by Messrs. THOMAS BOLTON AND SONS, LTD., Widnes, is of a serviceable type with large monthly sheets bearing illustrations of the company's products.

The 1930 calendar of Messrs. ERNEST F. MOY, LTD., Greenland Place, Camden Town, N.W.1, is a neat desk pattern with monthly date cards.

Mr. CHRISTOPHER WADE has sent us a charming calendar with monthly slips, illustrating in beautiful colours an Eastern scene, entitled "A City of Splendour."

A desk calendar with daily slips has been received from Messrs. B. S. & W. WHITELEY, LTD., Pool Paper Mills, Pool-in-Wharfedale.

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Unemployment.

There was an increase of 17,442 in the number of registered unemployed during the week ended December 2nd. At that date the total was 1,302,900, as compared with 1,285,458 on November 25th, and 1,350,806 on December 3rd, 1928.

A Bilingual "Osram" Sign.

The accompanying views show a large sign in operation in India. It flashes different advertisements at ten-second intervals, and is visible the whole length of Chowringhee, an important Calcutta thoroughfare. The sign is legible at a distance of three-quarters of a mile and is fitted with no fewer than 5,400 "Osram" lamps. There is a lead and return for each lamp, and a large quantity of wire and cable of "Pirelli-

"Osram Lamps" in English and Bengali.

General" manufacture is employed in the installation. As the pictures show, the word "Osram" is flashed out alternately in English and Bengali, and the natives are now as familiar with the meaning of this word as are the numerous English and European residents.

The E.D.A. January Programme.

The Outlet Campaign and the advocacy of the use of miscellaneous appliances form the subjects of the January activities of the British Electrical Development Association. The special window display, in arranging which E.D.A. offers assistance to dealers, is illustrated herewith. The principal expense connected with the display material (apart from the appliances) is the cost of the silver "cubes," but these have already appeared in previous displays, and most retailers who follow E.D.A.'s suggestions should have them in their possession. An attractive background is provided by orange and white crêpe paper radiating from one of the special Campaign showcards.

The national advertising introduces the lady of the showcard and the slogan "Plug in to Comfort." The importance of adequate electrical facilities in the home is stressed in an effective manner. The block for use in local newspapers is of a similar character, and the phrase, "Have your Electrical Installation Brought up to Date," figures boldly in the announcement. The same advertisement is available in the form of a lantern slide for kinema and theatre use. The programme sets out a number of appropriate E.D.A. publications and their moderate prices. Another feature of the programme is a poster calendar for 1930. Particulars are also given of the January Salesmanship Conferences, and there are some notes by the Director.

Great Britain's Radio Exports.

During October last the value of radio apparatus exported from this country was £84,546, including valves valued at £14,917. Italy was the leading importer, having taken goods valued at £9,774 (valves £1,143); Holland was second with £8,950 (valves £214). Other leading customers were the Irish Free State £6,250 (valves £1,531); India, £6,078 (valves £832); Australia, £5,994 (valves £2,164); the Union of South Africa, £4,281 (valves £1,115); and Belgium, £3,706 (valves £458).

New French Companies.

The following companies have recently been established in France: The Société Electro Métallurgique du Bourget, Bourget (Seine), capital 100,000 fr.; La Société de Traction et de l'Electricité, Paris, 260,000,000 fr., to acquire, and amalgamate the businesses of the Société d'Electricité et de Traction, and the Compagnie Auxiliare d'Electricité et de Transports; and La Société Union Electrique de la Région Vendéenne, Paris (9, Rue Louis Murat), 2,000,000 fr.

South American Trade.

Diplomatic representatives of Brazil, Argentina, and Uruguay were entertained at dinner by Mr. A. Henderson, Foreign Secretary, on December 11th, and Lord d'Abernon and members of the recent Economic Mission to South America were also present.

Mr. W. Graham, President of the Board of Trade, said that since the war the United States had stepped into the position in South American trade which was formerly held by Great Britain. Our immediate task was to make every effort to regain that position, and he hoped that the result of the Mission's visit would be to bring the South American countries into closer touch with us.

The Brazilian Ambassador said that the Mission had greatly impressed his countrymen as a proof of Great Britain's desire to strengthen the bonds uniting the two countries. He hoped that in the near future Great Britain would be taking greater quantities of Brazilian products. Brazil offered a vast market to British manufacturers, whose workmanship was fully recognised. He felt sure that they would find greater outlets for their goods as a result of the Mission's work, combined with a close study of the language and tastes of the Brazilian consumer.

Lord d'Abernon spoke of the high esteem which Great Britain enjoyed in South America, but said that British trade was not commensurate with the depth of that regard. In comparison with the possibilities the present development was merely moderate. The development of foreign trade was not necessarily detrimental to the Imperial conception. Both foreign and Empire trade were necessary to British prosperity. It was possible, however, that we might use the argument of Imperial trade in our negotiations with foreign countries so as to secure reciprocity in our dealings with them. He hoped that Sir Malcolm Robertson's optimistic view of the probable results of the Commission's work would be fully justified.

The Brussels Wireless Exhibition.

The British Commercial Secretary at Brussels informs the Department of Overseas Trade that the Annual Radio Salon which took place in that city from October 12th to 21st,

The E.D.A. January Display.

was well attended by the public. Material of British manufacture was well represented. In fact, the general impression gained at the show was that this year British participation "swamped" both the local and foreign elements, alike in range and quality. Many of the latest specialities from the recent Radio Exhibition at Olympia, including a varied range of electrically-operated wireless-gramophone sets built into handsome cabinets, electrical gramophone amplifiers, &c.,

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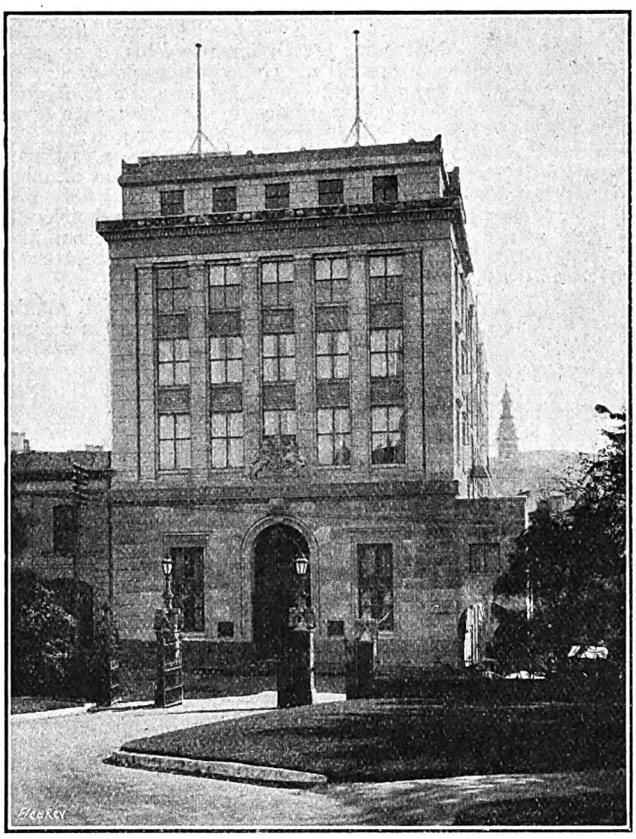
attracted marked attention. Accessories, such as loud-speakers, valves, &c., of British origin, were also much in evidence. Agents exhibited material from France and Germany at a few stands, and offered payment by instalment terms to buyers. The few existing Belgian manufacturers of importance showed a varied range of goods at prices considerably below the level of those of foreign competitors.

A Special New Zealand Installation.

The accompanying illustration shows the Public Trust Office, Dunedin, New Zealand, which has recently been wired. This electrical installation is the first of its kind in Otago on a complete draw-in system dispensing with inspection fittings on the concealed parts. All the wires are stranded and are run in galvanised conduit sunk into the concrete; inspection fittings could not be used as the floors were cemented over and the ceilings plastered. The pipes were bent and the looping done at the ceiling outlets, special cast steel boxes being made locally



The Public Trust Office, Dunedin.

as the Government regulations in New Zealand require that a wire may be easily replaced at any time. The building created so much local interest that the public was admitted during the opening week. The installation was carried out by the Dunedin branch of Turnbull & Jones, Ltd. All the cables were of Henley's make, and Henley ruptor switches and fuses were employed on the main circuits. We are indebted to W. T. Henley's Telegraph Works Co., Ltd., for the photograph.

The Christmas Holidays.

The works and offices of BROOKHIRST SWITCHGEAR, LTD., will be closed from noon December 24th to the morning of December 27th.

The JACKSON ELECTRIC STOVE CO., LTD., states that its offices will be closed from Tuesday evening, December 24th, until Saturday morning, December 28th.

The works of Messrs. REAVELL & Co., LTD., will be closed from the afternoon of December 24th until the morning of December 30th.

The MIDLAND ELECTRIC MANUFACTURING CO., LTD., informs us that its stores will be closed for stocktaking from noon, December 24th, to the morning of January 1st.

Bankruptcy Proceedings.

L. W. WESTBURY, 383, Birmingham Road, Walsall, lately trading as L. W. Westbury & Co., and also as the Walsall Radio Co., 146, Lichfield Street, Walsall, wireless goods dealer. —The public examination of this debtor was held on December 12th at the Court House, Walsall, when a statement of affairs was filed showing liabilities of £1,308, and a deficiency of £1,289. The examination was adjourned for closing.

J. WYNDHAM (Wyndham's Wireless & General Manufacturing Co.), 114, Tottenham Court Road, W.1.—Receiving order made December 5th on creditor's petition. First meeting yesterday (Thursday) at Bankruptcy Buildings, Carey Street, W.C.2; public examination, January 21st, at the same address.

J. J. BROWN, wireless agent, 79, Fairholm Road, Benwell, Newcastle-upon-Tyne.—Receiving order made December 5th on a creditor's petition. First meeting December 20th, at the Official Receiver's office, 81, St. Mary's Place, Newcastle-on-Tyne. Public examination, January 8th, at the Court House, Newcastle-on-Tyne.

F. V. LAMBERT, electrical contractor, 27, Parrock Street, Gravesend.—Bankrupt's discharge suspended until January 13th, 1930.

K. P. J. JOLIVARD (K. Jolivard & Co.), electrical engineer, 66, Victoria Street, S.W.—First and final dividend of 4d. in the £, payable at Carey Street, W.C.

E. C. JENKINS, wireless dealer, 11, Brook Road, Ashley Road, Bristol.—Trustee, Mr. H. Aston, Official Receiver, 26, Baldwin Street, Bristol, released December 3rd, 1929.

R. H. WARMINGTON, electrical engineer and contractor, 26, Stackpool Road, Southville.—Trustee, Mr. Hashton, Official Receiver, 26, Baldwin Street, Bristol, released December 3rd, 1929.

R. YEEND (Central Electricity Works), electrician, 19, Victoria Avenue, Lynn Road, Wisbech.—Trustee, Mr. F. H. Langmond, Official Receiver, 41, Sidney Street, Cambridge, released December 3rd, 1929.

Company Liquidations.

SUPER ELECTRIC HEATERS, LTD.—A meeting of members is called for January 8th at 3, Warwick Passage, Corporation Street, Birmingham, to hear an account of the winding up from the Liquidator, Mr. F. E. Bendall.

KIDDERMINSTER & STOURPORT ELECTRIC TRAMWAY CO.—Winding up voluntarily. Liquidators, Mr. H. G. W. Teverson, Mucklow's Hill, Halesowen, and Mr. C. D. Borer, 88, Kingsway, W.C.

For Sale.

Offers are invited for the purchase of surplus plant from Frindsbury power station. Particulars and specifications from Messrs. W. E. Fischer, Ltd., 8, Water Lane, E.C.3. Walton-upon-Thames Urban District Council has a number of second-hand d.c. meters for disposal. (See our advertisement pages to-day.)

New Catalogues and Lists.

PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2.—A special number of the house organ of the Australasian Philips Company, issued to celebrate the jubilee of the electric lamp. It contains many interesting illustrated notes.

ELECTRICAL EQUIPMENT & CARBON CO., LTD., Bank Buildings, 107-111, New Oxford Street, W.C.1.—List No. 26/29 showing various types of connectors and terminals for overhead lines. Illustrated and priced. Also a leaflet referring to the "Mignon" hand drilling machine.

Messrs. CAPEL & Co., LTD., XL Engine Works, St. Peter's Street, Colchester.—A number of illustrated pamphlets drawing attention to "XL" vertical engines and lighting sets, and "Excelite" belt-driven generating sets.

Messrs. HEYES & Co., LTD., Water-Heyes Electrical Works, Wigan.—An illustrated and priced catalogue of "Wigan" signalling apparatus (electrical).

SAFAC ACCUMULATOR CO., LTD., 36, Raymouth Road, Bermondsey, S.E.16.—A folder giving capacities, dimensions, and prices of "Safac" non-sulphating accumulators.

SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., 38-39, Upper Thames Street, E.C.4.—Catalogue No. 428 describing the "Seelco" wiring system. Illustrated and priced.

Messrs. FERRANTI, LTD., Hollinwood, Lancs.—A descriptive catalogue (pp. 507) for 1929-30, detailing the company's products. It is divided into six sections covering house service meters, non-magnetic cast iron, transformers, instruments, radio apparatus and heating equipment. In addition to a detailed index it also contains a general index to catalogue sections, and is fully illustrated. The volume is bound in strong leatherette and has the company's name inscribed in gilt letters on the cover.

MULLARD WIRELESS SERVICE CO., LTD., Mullard House, Charing Cross Road, W.C.2.—A leaflet drawing attention to the company's type "K" cabinet loud-speaker.

Messrs. RICHARDSONS, WESTGARTH & Co., LTD., Hartlepool. —A well produced and illustrated brochure describing steam turbines constructed by the company to the Brown Boveri Company's designs.

Messrs. MAYALL & Co., LTD., 61, Moor Street, Birmingham. —An illustrated price list of electrical accessories.

Messrs. DRAKE & GORHAM WHOLESALE, LTD., 67, Long Acre, W.C.2.—Pamphlet No. 471, containing illustrations, prices, and brief details of wireless receivers, loud-speakers, h.t. batteries, l.t. accumulators, &c.

FRIGIDAIRE, LTD., Frigidaire House, Chapter Street, Westminster, S.W.1.—A well-produced brochure drawing attention to "Delco-Light" sets for private house lighting and "Delco-Light" deep well pumps. Dimensions, capacities and prices are given, and some excellent illustrations in colour are also included.

Messrs. MAVOR & COULSON, LTD., 47, Broad Street, Mile End, Glasgow.—Pamphlet No. 258/1, giving illustrated particulars of the company's flameproof controllers.

Trade Announcements.

The UNIVERSAL HOUSING CO., LTD., which has a department for electrical installation work, has opened premises in Peel Road, Douglas, Isle of Man.

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The works of Messrs. CAPEL & Co., LTD., have been removed from 168, Dalston Lane, E.8, to the "XL" Engine Works, Colchester.

The telephone numbers of the HART MANUFACTURING Co., 76, Rochester Row, S.W.1, are now Victoria 2087 and 2088. To cope with greatly increased business, additional stock rooms have been acquired, situated above the premises in Rochester Row.

The WHITWORTH ELECTRIC LAMP Co., LTD., is acquiring, from January 1st, the wholesale distributing business of Dormor & Co., 217, Old Christchurch Road, Lansdowne, Bournemouth. Mr. O. A. Plimsaul, the present manager, will remain in charge. The company is also forming a subsidiary—Whitworth Electrical Repairs, Ltd.—to deal with all classes of repairs to electrical appliances.

The large new chromium plating works which have been established by the NORTHERN CHROMIUM Co., LTD., in Skinnerburn Road, Newcastle-on-Tyne, were officially opened on December 18th, by Sir Andrew Duncan, Chairman of the Central Electricity Board.

Recent Contracts.

It was announced last week that the Egyptian Government had awarded a contract valued at £67,000 for the extension of the Gabbari (Alexandria) railway power station to the Metropolitan-Cammell Carriage, Wagon & Finance Co., Ltd.

Important orders received by Hart Accumulator Co., Ltd., recently include one for two batteries, each consisting of 25 "S.T.F. 67" cells, having capacity of 9.693 Ah, to be installed in the new Whitehall telephone exchange.

Book Notice.

"Loaded Submarine Telephone and Telegraph Cables." Pp. III+60; figs. 23. Woolwich: Siemens Brothers & Co., Ltd.—Submarine cables already play an invaluable part in international communication, but until the advent in recent years of "loaded" cables the service was restricted, so far as telephone traffic was concerned, to short distances. The artificial introduction of inductance to the cables has not only enabled the speed of telegraph transmission to be greatly increased, but has also achieved a result even more far-reaching and significant, *viz.*, the transmission of the human voice over far greater distances than was possible with unloaded cables. Already, the distances spanned by submarine telephone cables are quite considerable, and it requires but little imagination to foresee the time when all the continents will be interlinked by a submarine telephone network. In providing such facilities electrical science may claim to have made another valuable contribution to the utilities of life. The book (it is well worthy of a better title than pamphlet 200A) which we have the pleasure of perusing, gives an account of the "loaded" submarine telephone and telegraph cables manufactured, and in most cases also laid, by Messrs. Siemens Brothers, who are amongst the pioneers in this branch of the electrical industry. The opening chapter deals with "loading" in a general way, while successive chapters contain illustrated descriptions, supplemented by copious tabular matter, of coil-loaded and continuously-loaded telephone cables insulated with gutta-percha and paper, respectively, and continuously-loaded gutta-percha-insulated telegraph cables. A brief mathematical treatise on telephone and telegraph transmission is given in an appendix.

Association of Ex-Siemens' Men.

A smoking concert will be held by the Association at Gatti's Restaurant, Strand, W.C.2, on January 14th. Tickets are 3s. each and guests will be welcomed. Mr. J. Snow Huddleston, M.I.E.E., Dagenham Dock, Essex, is the hon. secretary, and will be pleased to give full particulars of the Association to any intending members.

Social Events.

The annual staff dinner of Messrs. Tamplin & Makovski, Ltd., was held recently at the Warwick Hotel, Redhill, Mr. A. W. Makovski (chairman of the company) presiding. In responding to the toast of "The Directors," Mr. Makovski said that to combat the intense competition which existed no firm could live unless its standard of work was high.

Henley's Dramatic Club has added yet another play to its long list of successful productions. This time it was Galsworthy's "The Skin Game," which was given at the Cripplegate Theatre on December 16th. The production reached a very high standard, and the acting of the whole company was first class. Particular mention may be made of the performance of Mr. W. G. Turner as Hillcrist (a country gentleman), and Miss Hilda Snedden as his wife. Mr. H. Stanley's interpretation of Hornblower (a *nouveau riche*) was a *tour-de-force*, and among the ladies Miss Fay Smith, as Chloe, and Miss Hilda Starbuck, as Jill (Hillcrist's daughter) gave spirited performances. The theatre was crowded, and the reception accorded the company was enthusiastic.

A Turbo-Alternator Development.

For many years Messrs. RICHARDSONS, WESTGARTH & Co., LTD., have built steam turbines at their Hartlepool works to the designs of Messrs. Brown, Boveri. They have recently completed shops for the manufacture of alternators as well, also to Brown, Boveri designs. The new shops are equipped for the production of alternators up to the maximum size and work has just commenced on the first three commercial machines for the Hartley Main Colliery Co., Ltd. These comprise one 3,000-kW and two 2,000-kW machines, 6,600 V, 40 cycles, operating at 2,400 r.p.m.

"Metrovick" Apprentices' Revue.

The M-V Apprentice Association gave performances of its annual revue, entitled the "Collaptimists," at the M-V Club, Stretford, from December 11th to 14th. There was a distinctly professional touch in the rapidity with which the items followed each other; not one empty minute occurred from the beginning to the interval, and from the interval to the end.

"Metrovick" Apprentices in Revue.

Some of the sketches, and those not the least interesting, were written, besides being produced and acted, by members of the Association. The dancing was distinctly vivacious, and the final item, in which four youths dressed and made up as pretty girls went through quite a lengthy stage dance with male partners, was thoroughly enjoyable; the verve and precision were excellent. There were full and appreciative houses all through. Mr. G. E. Bailey (director) and Mrs. Bailey were present on the first night.

The British Industries Fair.

The following is a list of exhibitors in the wireless section of the British Industries Fair, which is to be held in the new and reconstructed Olympia, London, from February 17th to 28th next:—

Amplifiers, Ltd.
Bakelite, Ltd.
Cole, E. K., Ltd.
Cook's Wireless Co., Ltd
Darwins, Ltd.
Eastick, J. J., & Sons.
Ever-Ready Co. (Gt. Britain), Ltd.
Formo Co. (Arthur Preen, Ltd.),
Halcyon Wireless Co., Ltd.
Igranic Electric Co., Ltd.
Indurite Agency.
Laker, John & James, Co., Ltd.
Lever, Eric J. (Trix), Ltd.
Lissen, Ltd.
London Radio Manufacturing Co., Ltd.
M.L. Magneto Syndicate, Ltd.
Neophone Engineering Co.
Ormond Engineering Co., Ltd.
Read Radio, Ltd.
Rees-Mace Manufacturing Co., Ltd.
Whittingham, Smith & Co.

Irish Free State Electrical Imports.

The imports of electrical goods, excluding machinery, into the Irish Free State during October last amounted to £64,154, bringing up the total for the first ten months of the year to £512,922 as compared with £410,003 in the corresponding period of 1928.

Merchandise Marks Inquiries.

Among the forthcoming inquiries into applications under the Merchandise Marks Act, 1926, is one relating to motor vehicles and accessories. The latter include dynamos, starting motors, magnetic cut-outs, dashboard fittings, high-tension distributors, ignition coils, magnetos, batteries and ignition plugs.

The Timber Market.

Our Timber Trade Correspondent reports that the market for European timber lacks steadiness, imports having been very heavy over the past five or six weeks, and consequently there are large stocks on the market. Some good Russian, Swedish, and Finnish parcels are being offered and taken up by consumers at attractive rates. On the whole, consumption is satisfactory—the moot point is whether it will be maintained. The larger Russian supplies to come forward next year presage cheaper prices for building and joinery woods, and it is hoped, will stimulate consumption and encourage house-building operations. Hardwoods, excepting the American varieties, are generally steady, in demand and value, both of Empire and foreign production. The fancy woods, such as mahogany, rosewood, satinwood, and ebony are very firm in price. Teak also commands a fair return. The price outlook for next year, so far as can be observed, is cheaper building woods, and dearer (if but slightly) furniture and cabinet woods.

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German Foreign Electrical Trade.

A return just issued shows that the imports of electrical machinery, cables and electrical fittings and accessories into Germany during the nine months ended September last, attained a value of £1,958,750, as compared with £1,597,300 in the corresponding period of 1928. The exports of similar material from Germany during the same period advanced from £17,980,900 to £20,766,750.

Prices of Materials.

Messrs. F. Smith & Co. and Messrs. James & Shakespeare report December 16th: No change in copper and lead prices.

Messrs. Edward Till & Co. report, December 16th: India-rubber, Para fine, 8¼d., ¼d. dec.

Messrs. James Forster & Co. state in their letter of December 14th that the lead market was again very quiet last week and transactions were mainly professional. The general position remains unchanged with supplies more than sufficient for consumption. Demand is poor and is unlikely to revive until after the turn of the year. Left to the natural law of supply and demand the price would undoubtedly stand to-day at a lower level, but, with the existing control exercised by the Producers' Association, prices may be maintained for the time being.

Lighting and Power Notes.

Arundel.—INAUGURATION OF SUPPLY.—The borough was recently connected to the Bognor Gas & Electricity Co.'s 11,000-V network by means of a three-mile overhead line.

Barrow-in-Furness.—MAINS EXTENSIONS.—The Corporation is applying to the Unemployment Grants Committee for a grant in connection with an extension of mains to the Kirkby Quarries, estimated to cost about £4,500.

Betchworth & Brockham.—ELECTRICITY SUPPLY PETITION.—A petition is to be made by the ratepayers and housholders of the parish against the Dorking Electricity Special Order 1929, promoted by the Greater London & Counties Trust, Ltd., now awaiting confirmation by the Ministry of Transport. If the Order is confirmed the charge for electricity, it is stated, will be three times that which would be made under the national scheme of the Central Electricity Board and the London & Home Counties Joint Electricity Authority.

Brighton.—THE ASSISTED WIRING SCHEME.—As a result of a conference between representatives of the Corporation Electricity Committee and the Electrical Contractors' Association with regard to certain details in connection with the working of the assisted wiring scheme, it has been decided to pay £1 per point to any contractor who undertakes the wiring of houses which fall within the assisted wiring scheme, subject to the materials to be used being approved by the electrical engineer, or being purchased from the department as the engineer may decide in any particular case.

LOAN SANCTIONED.—The Committee has obtained sanction to the borrowing of £50,000 for electricity mains and services.

Burnley.—ELECTRICITY SUPPLY EXTENSION.—The Town Council has decided to give a supply of electricity to Cliviger at an estimated cost of £5,500.

Colchester.—BULK SUPPLY.—The Corporation Electricity Committee has arranged an interview with the engineer of the Frinton-on-Sea & District Electric Light & Power Co., Ltd., to discuss terms for a bulk supply by the Corporation, and is also to consider the installation of additional generating plant.

NEW CABLES.—The borough electrical engineer submitted particulars of the lengths of cables which it will be necessary to lay in various streets in the borough within the next 12 to 18 months, the approximate total cost being £5,462. An estimate for completing the e.h.p. ring main within the borough, at a cost of £19,430, was also submitted.

Continental.—GERMANY.—A 440,000-kW generating station just completed at Bitterfeld, Saxony, is stated to be the largest electric power station in Europe. It will be used to supply electrical energy to the whole of middle and east Germany.—*Reuter.*

FRANCE.—The Société Union des Producteurs d'Electricité des Pyrénées Occidentales has recently secured a concession to establish a hydro-electric station to utilise the power of three falls on the River Nesta in the Upper Pyrenees.

Darlington.—SPECIAL ORDER.—The Corporation is to apply to the Electricity Commissioners for a Special Order authorising it to take over from the Cleveland & Durham County Electric Power Co.'s undertaking the parishes or townships of Barmpton, Great Burdon, Haughton-le-Skerne, Morton Palms, Neasham, Sadberge, and Whessoe, in the rural district of Darlington.

Dartford.—ELECTRICITY SUPPLY EXTENSIONS.—The Urban District Council Electricity Committee recommends that work be commenced as soon as possible in carrying out a portion of the second instalment of the ring main scheme, which comprises the laying of a high-pressure cable from the sub-station in Princes Road to Temple Hill, and the construction of a sub-station in Princes Road at Temple Hill, at an estimated cost of £6,500.

Dewsbury.—BULK SUPPLY.—The Town Council has decided, subject to the approval of the Electricity Commissioners, to enter into an agreement with the Yorkshire Electric Power Company for the supply of electricity in bulk for distribution by the Corporation. Dewsbury's power station is scheduled to cease generation under the "grid" scheme, and the existing supply agreement with the power company is due for revision within the next few months. The station will become a transforming station, the supply being between five and six million kWh per year.

East Grinstead.—LOAN.—The Urban District Council has applied for sanction to a loan of £10,000 for mains, services and meters.

Glasgow.—MAINS EXTENSIONS.—The Corporation Electricity Committee recommends that distributing mains be laid at an estimated cost of £9,765.

ELECTRICITY CHARGES PETITION.—Representatives of tenants in Glasgow Corporation houses have considered the reply of the Clyde Valley Electrical Power Co., to complaints regarding charges for electricity, and have agreed to arrange for a petition to the Government for an official inquiry into the methods of charging for electricity.

PROGRESS DURING OCTOBER.—Under the Glasgow Corporation Electricity Department's scheme, 848 houses were wired in October, making the total to date 17,549. Appliances let out on hire numbered 583, making the total 19,193.

CHANGE OF FREQUENCY.—Regarding the change of frequency in the north-west district of the city, the manager of the Corporation Electricity Department has reported that a complete survey has now been made and that the approximate cost of the change-over will be £248,000, made up as follows:—Generation, £35,000; inter-connection, £5,000; distribution, £131,000; consumers, £65,000; management £12,000. The committee has approved the report as an indication of the cost of carrying out the section of the scheme referred to, and has instructed the manager to submit it to the Central Electricity Board.

Halifax.—LOAN.—The Town Council is to apply for sanction to a loan of £100,000 for the extension and replacement of mains during the next three years.

Hampton.—PROPOSED SALE OF UNDERTAKING.—At a recent meeting of the Urban District Council a letter was received from the town clerk of Twickenham, enclosing a copy of one from the Twickenham and Teddington Electric Supply Co., Ltd., respecting the purchase of the company's undertakings at Twickenham, Teddington, and Hampton, stating that, subject to a satisfactory price being reached by agreement, the company will be prepared to sell the Hampton Wick undertaking. The communication was referred to the Council's representatives.

CABLE EXTENSIONS.—The Twickenham and Teddingon Electric Supply Co., Ltd., is to extend cables in Queen's Road and Burton's Road, Hampton Hill.

Hastings.—LOANS SANCTIONED.—The Corporation Electricity Committee has obtained sanction to loans of £7,000 for mains and services, and £450 for sub-station equipment.

Heywood.—ELECTRICITY SUPPLY.—The Town Council is to open negotiations with the Bury Town Council with a view to extending the supply of electricity.

Leigh (Lancs.).—MAINS EXTENSIONS.—The Town Council has received sanction to a loan of £6,929 for laying conduit lines and cables, and providing sub-station transformer equipment in the West Leigh and Pennington areas of the borough.

Lochaber.—HYDRO-ELECTRIC SCHEME.—According to *The Times* the Lochaber (Inverness-shire) hydro-electric scheme, started in 1925, is now reaching its final stages. A series of tests is now being made, and for this purpose water from subsidiary streams has been let into the 15-mile tunnel which has been driven through the solid rock of the Ben Nevis range. Recent tests permitted of the turbines being run light at full speed, and it is understood that the results were entirely satisfactory. The crucial test, however, cannot take place until the last rock barrier, excluding the waters of Loch Treig from the tunnel has been blasted. It is expected that this will be completed before the end of the year.

London.—KENSINGTON.—A report of the Borough Council Works Committee states that a scheme is in course of preparation for further improvements in the street lighting, dealing first with the classified roads, next with roads not classified but traversed by buses or other considerable traffic, and then with streets in defined areas which can be dealt with completely and in sequence.

HAMPSTEAD.—At an emergency meeting of the Borough Council, held recently to consider the failure of the electricity supply three times during the last few weeks, it was decided that the Lighting Committee should be authorised to obtain expert opinion as to the causes of the breakdowns; the present administration of the lighting station, and the possibilities of obtaining additional power in the immediate future; and to advise as to the measures to be taken to secure continuity of supply in future.

Manchester.—PROGRESS DURING OCTOBER.—During the month of October the Corporation electricity undertaking showed an increase in connections of 2,416 kW, bringing the

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total up to 398,400 kW. The number of applications received for supply including those for additional supplies, was 1,616, representing a total of 3,536 kW. The number of hired cookers connected increased by 96, bringing the total number of cookers actually connected to 5,701. Applications for the hire of cookers totalled 113. Three new sub-stations were put into commission and additional plant was installed at three existing sub-stations. The change-over from d.c. to a.c. had been completed in the cases of 8,502 consumers up to November 16th, and sanction had been given and work was in progress involving 1,214 consumers.

COOKER HIRE CHARGES.—Consequent on the earlier designs of electric cookers falling out of favour with hirers, and to prevent an accumulation of these in the stores, the Corporation Electricity Committee has reduced the charges for these older types from 7s. 6d. to 6s. per quarter.

Peterborough.—LOAN.—The Town Council has applied for sanction to a loan of £25,000 for the provision of l.p. mains, cookers, and meters.

Portsmouth.—LOANS SANCTIONED.—The Corporation Electricity Committee has received sanction to loans of £1,759 for the purchase of sites and erection of sub-stations at Lee-on-Solent, Gable Head and Stubbington, and £16,000 for electricity mains in connection with the extension to Sarisbury.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

LONDON.—*St. James' & Pall Mall Electric Light Co., Ltd.*—Power, heating and cooking: From 1d. to ¾d. per kWh. The "minimum charge" for lighting: From 10s. to 6s. per quarter for the winter quarters, and to 4s. per quarter for the summer quarters.

SEVENOAKS.—*Sevenoaks & District Electricity Co., Ltd.*—Domestic lighting: From 9d. to 8d. per kWh. Shop lighting: To 7½d. per kWh. Heating: To 1½d. per kWh.

Rotherham.—EXTENSION OF SUPPLY AREA.—Clauses are to be included in the Bill to be promoted by the Corporation in the ensuing session of Parliament, to extend the electricity supply area at Thorpe, so as to include the whole of the Thorpe Hesley and Hesley Bar.

Shropshire.—ELECTRICITY SCHEME.—The West Midland Joint Electricity Authority, whose headquarters are in Wolverhampton, has approved a £300,000 scheme for the distribution of electricity in the north-eastern section of Shropshire, which embraces 109 sq. miles and has an estimated population of 68,000. The area includes the Wellington, Newport, Oakengates and Dawley urban districts, part of the municipal borough of Wenlock, embracing Madeley, Coalbrookdale and Ironbridge, and parts of the rural districts of Wellington, Newport Shifnal and Atcham. The proposed works include 33,000-V transmission lines to connect Ironbridge, Wellington, Newport and Shifnal with double-circuit mains where required, in order to provide alternative routes as a safeguard against breakdown. The scheme is being submitted for the approval of the Electricity Commissioners, and when this is forthcoming the work will be commenced.

Torquay.—ELECTRICITY SUPPLY.—At a meeting of the Corporation Electricity Committee held recently, the town clerk reported that the Extension (No. 2) Order had now been made by the Electricity Commissioners, and the Electricity Department was instructed to make a survey of the area of supply and to submit a scheme or schemes to deal with that area as soon as possible. In regard to the Extension (No. 3) Order, the town clerk reported that the application for this Order had been lodged with the Electricity Commissioners who stated that they were prepared to consider the application of the Corporation to give supplies of electricity in bulk to the Urban Electric Supply Co., Ltd., at Dartmouth, and the Salcombe Gas & Electricity Co., Ltd., at Salcombe and Kingsbridge, but that they would defer giving approval in the latter case until the inquiry into the application for the Extension (No. 3) Order had been held.

Warrington.—LOAN.—The Town Council has applied for sanction to a loan of £1,716 for h.p. mains from Winwick to Croft, and the provision of a sub-station at Croft.

Western Australia.—YEAR'S WORKING.—The report on the working of the Government electricity undertaking (general manager, Mr. W. H. Taylor) for the twelve months ended June 30th last, records a total revenue of £278,886, as compared with £246,804 for the preceding year. The working expenditure amounted to £214,529, as against £191,443, leaving a gross profit of £64,357 (£55,361). Interest charges absorbed £56,654 and there was a net surplus of £7,703, as compared with £11,734 in 1927-28. The capital expended increased from £922,395 to £1,210,710, the principal item being £256,535 for power station extensions. The electrical energy sold increased from 60,932,360 to 68,539,228 kWh, and the maximum supply demanded from 17,300 to 20,000 kW. The average price obtained per kWh rose from 0.96d. to 0.97d. Extensions of the power station consisting of the fifth unit were completed during the year, and preparations are being made for work to commence on the sixth unit as soon as possible.

York.—SCHOOL LIGHTING.—At a recent meeting of the Corporation Education Committee it was reported that of the 18 non-provided schools in the city, electric lighting had been installed in 13, and it was decided to urge the managers of the five remaining schools to change over from gas to electricity as soon as possible.

Tramway and Railway Notes.

Australia.—NEW SOUTH WALES.—The report of the New South Wales Railway Commissioners for the year ended June 30th last, states that the total revenue obtained from the electric trams in the Sydney metropolitan area amounted to £4,061,459, as against £4,135,337 in the previous year. The working expenditure was £3,471,394, as compared with £3,465,920, leaving a gross profit of £590,065 (£669,417). From this had to be paid £514,478, interest on loans, and £27,086, contribution to sinking fund, leaving a net surplus of £48,501, as compared with £163,394 in the preceding year. The number of passengers carried decreased from 322,025,235 to 312,032,469, and the car mileage from 31,511,169 to 31,258,936.

The gross revenue from the Newcastle tramways was £351,363, as compared with £374,420 in 1927-28. Working expenses were £301,577, as against £307,637, while the gross profit decreased from £66,783 to £49,786. Interest on loans absorbed £80,254 and sinking fund a further £4,225, leaving a net deficiency of the year of £34,693, as compared with £11,192 in the previous year. The number of passengers carried decreased from 20,180,992 to 17,807,702, and the car miles run from 2,645,486 to 2,505,805. Most of the tramcars are now operated by electricity and the few steam vehicles which remain are to be replaced by electric cars.

Details are also given in the report of the steam power stations which generate the power required for the railways and tramways of Sydney and Newcastle. The total energy generated during the year by the Ultimo and White Bay stations at Sydney, was 420,708,460 kWh, as against 393,128,095 kWh in the preceding year. Of this 115,658,827 kWh was utilised for the electric railway system, and 116,011,600 kWh was taken in bulk by the Sydney Municipal Council. There was an increase from 51,052,260 to 55,976,614 kWh in the electrical energy generated at the Zarra Street station at Newcastle, and of this 40,403,882 kWh was sold in bulk.

Bradford.—RAILLESS-CAR EXTENSIONS.—The Corporation Tramways Committee recommends the extension of the railless-car service from Five Lanes End, through Idle to the Albion Mills at Greengates, as it is reported that the tramway track to Idle is worn out. A railless-car service will shortly come into operation on the Thackley route.

Colchester.—TRAMWAY ABANDONMENT.—The Corporation tramway service has now been completely replaced by motor-'buses.

Rotherham.—RAILLESS CARS.—The Corporation Transport Committee has appointed a sub-committee to decide upon the type and to accept a tender for the supply of twenty railless cars for operation on the Dalton and Kimberworth routes.

Western Australia.—YEAR'S WORKING.—We have received from Mr. W. H. Taylor, general manager of the Government tramway undertaking, a copy of his report for the year ended June 30th last. The total revenue amounted to £342,788, as compared with £318,957 in the preceding year. Working expenses, including £21,000 for relaying of track, totalled £281,257, as against £259,677, leaving a gross profit of £61,531 (£59,280). After providing for capital and other charges there was a net surplus of £11,376, as compared with £10,481 in 1927-28. The capital expenditure during the year amounted to £19,105, bringing the total now spent on the undertaking to £1,069,352. The number of passengers carried increased from 32,657,626 to 35,031,734, the car mileage from 3,188,087 to 3,345,929, and the revenue per car mile from 24.01d. to 24.59d.

Telegraph and Telephone Notes.

Australia.—AUTOMATIC TELEPHONY.—The Central and Paddington automatic telephone exchanges have just been successfully opened for public service at Brisbane. The event is notable because the transfer of the two exchanges, totalling nearly 10,000 lines, is the largest so far undertaken in Australia. Conversion to the automatic system was commenced in 1925, when the South exchange, with nearly 4,000 lines, was opened. Since then the system has steadily grown until it now comprises three main automatic exchanges and seven satellite exchanges equipped for a total of over 20,000 lines. All the automatic exchanges in the Brisbane area have been manufactured and installed by Messrs. Siemens Brothers & Co., Ltd., Woolwich.

Channel Islands.—TELEPHONE CABLE.—A scheme to use a secret submarine cable, which was laid across the English Channel during the 1914-18 war, to provide a telephone service between the Channel Islands and the mainland has been placed before the British authorities by the Telephone Council of Guernsey. The cable, said Deputy Charles Kitts, addressing the Guernsey Chamber of Commerce, was laid between Dartmouth and France, and passed close to the western coast of Guernsey. By tapping it at the nearest point, it should be possible to establish direct telephone communication between

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England and the Channel Islands at a reasonable cost. He added that, as a member of the Telephone Council, he had seen responsible people in London with regard to the project, and they were impressed with the advantage of a cheap telephone service for British buyers of the fruit, vegetables, and flowers exported in such large quantities from the islands. The line tapping the cable would come ashore probably at Saints Bay, and Guernsey would be the central exchange for the islands. The telephone authorities in London confirm the statement that negotiations are in progress with the island authorities.

France.—RURAL TELEPHONY.—In the National Development Bill just submitted to the French Parliament, a sum of £1,700,000 is provided for the development of automatic telephone systems in rural districts, the expenditure to be spread over a period of five years.

Radio-telephony.—POLICE SERVICE.—If Parliament gives its sanction, France will shortly have a wireless police service. Besides permitting rapid communication between Paris and the provinces, it will be at the disposal of the international police organisation (see ELEC. REV., December 13th, 1929, p. 1052). By direct wire to the Eiffel Tower, the French Sûreté will be able to transmit descriptions and also photographs and finger prints. Fifty-one provincial receiving stations will be established.

Russia.—TELEPHONE RESEARCH.—A large new central laboratory for research work in long-distance telephony and telegraphy has lately been completed in Moscow.

The Telephone Service.—STEADY INCREASE.—The total number of telephone stations in the British Post Office system on September 30th, 1929, was 1,814,263, a net increase for the month of 10,336, of which total 161,623 were in Scotland and 22,448 in Northern Ireland. London's share was 647,967, an increase of 3,527 for the month, of which 157,083 were residence-rate subscribers (month's increase 1,361) and 5,717 were call-office stations, including 1,479 kiosks. The provinces claimed 1,166,296, the increase for the month being 6,809, of which 247,645 were residence-rate subscribers (month's increase 2,067) and 22,952 were call-office stations, including 5,662 kiosks.

TRUNK CALLS.—The total number of inland trunk calls dealt with in July, 1929, was 10,653,433, representing an increase of 1,150,626, or 12 per cent., over the total for the corresponding month last year.

INTERNATIONAL TRAFFIC.—Out-going international calls in July, 1929, numbered 46,774 and incoming international calls 49,742, representing increases of 11,031 (30.9 per cent.) and 11,236 (29.2 per cent.) respectively, over July, 1928.

U.S.A.—CABLE AND WIRELESS UNIFICATION.—The unification of the American wireless and cable telegraph communication systems to meet foreign competition was advocated before the Senate Inter-State Commerce Committee on December 9th by Mr. Owen D. Young, chairman of the Radio Corporation of America. He said that Great Britain and France had already introduced unification, and Germany was doing so; in Italy and Japan the services were unified under Government control. He declared that it was impossible for competitive companies in America "to meet these consolidated units in other countries from the standpoint of national interest."—*Reuter's* (Washington).

Radio Notes.

A Wireless Anniversary.—TRANSATLANTIC RECEPTION.—Thursday, December 12th, was the 28th anniversary of the Marchese Marconi's historic reception at St. Johns, Newfoundland, of the first wireless signal to be received across the Atlantic Ocean. The first British patent for wireless telegraphy taken out by the Marchese Marconi was dated June, 1896, four months after he came to this country from Italy. At the request of the National Broadcasting Company of America and by the co-operation of the British Broadcasting Corporation and the British Post Office, the Marchese Marconi broadcast from England for retransmission through the American stations a description of his experience at St. Johns, Newfoundland, when receiving the famous "S" signal from Poldhu, Cornwall, on December 12th, 1901. The broadcast was transmitted to the United States through 5SW, the short-wave experimental station at the Marconi works, Chelmsford. The Marchese Marconi spoke from the Savoy Hill studios, and had with him Mr. G. S. Kemp and Mr. P. W. Paget, two of his earliest assistants who were with him at St. Johns in 1901, and who are still working in association with him.

Modulation.—U.I.R. RECOMMENDATION.—In the course of its meetings, held recently at Barcelona, the Council of the Union Internationale de Radiodiffusion adopted the report of its Technical Committee on the results of the Prague plan of wavelength allocation. The Council agreed to the steps recommended by the Technical Committee towards the more rigorous enforcement of measures to restrict broadcasting stations to the wavelengths accorded to them, and to reduce the grave interference occasioned by over-modulation practised by some Continental stations, producing harmonics of the modulating low frequency.

The B.B. Co.—WOUND UP.—The British Broadcasting Company formally ceased to exist on December 12th, 1929. Its last statutory meeting, which was private, was held in London to receive from Sir John Reith, the liquidator, an account of how its property had been disposed of. The first B.B. Co. programme was transmitted from the London (2LO) station on November 14th, 1922. The Corporation, which succeeded the Company, was instituted by Royal Charter on January 1st, 1927.

Wireless in Schools.—BATTERY ELIMINATORS.—The L.C.C. Education Committee, reporting upon the use of wireless apparatus in elementary schools, says that it has been the general practice to decline applications for the fixing of wireless apparatus to electric light installations, but in view of the general tendency of manufacturers to contruct sets which require no batteries, the committee considers it desirable that such facilities should be provided for the use of the most modern apparatus in the Council's schools, provided that its chief engineer is satisfied about the suitability and safety of the apparatus. The cost of the electricity used by wireless apparatus is practically negligible, but the committee does not undertake to defray the cost of the apparatus.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—Posts and Telegraph Department. January 7th. Telephone hand sets. (B.X. 5823.)* Contact pressure testers. (B.X. 5821.)* Telephone cable and terminal boxes. (B.X. 5938.)

January 14th. Ringing motor-generator sets for automatic telephone exchanges. (B.X. 5839.)* Telephone indicators. (B.X. 5822.)*

January 28th. Induction coils and register plates. (B.X. 5899.)*

February 25th. Jumper rings and terminal strips. (B.X. 5941.)*

February 18th. Jacks and number plates. (B.X. 5940.)*

January 13th. State Electricity Commission of Victoria. 2,200-V switchgear and accessories. (B.X. 5827.)*

Belgium.—January 8th. Belgian Post and Telegraph. Salle Madeleine, Brussels. 250 tons of bronze wire, in five lots, and five tons of annealed soft copper wire. Particulars (Cahier des Charges Special No. 3455) for 2½ francs.

Bradford.—December 31st. Corporation electric passenger- and goods lifts at block of shop and office premises, Leeds Road, Bradford Street, and Hall Buildings. Form of tender from city architect, Town Hall.

Dumbartonshire.—The Education Authority is inviting tenders for the installation of electric light in Cardross Public School.

Dundee.—January 15th. Electricity Department. Supply of two 300-kVA outdoor-type transformers and one 200-kVA outdoor-type transformer. (See this issue.)

Edinburgh.—December 23rd. Education Authority. Electric installation at Nursery School, Tollcross. Schedules from Authority offices, Castle Terrace.

Egypt.—CAIRO.—December 28th. Ministry of Public Works. Electric generating and pumping sets for Mankabad Barracks. (B.X. 5842.)*

February 1st. Ministry of the Interior. Centrifugal well pump and direct coupled electric motor with piping and accessories. (A.X. 8811.)*

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Leeds.—December 27th. Board of Guardians. Electric lamps for the period ending March 31st, 1930. J. H. Ford, Clerk to the Guardians, Poor Law Offices, 11, South Parade, Leeds.

Liverpool.—December 23rd. Electricity Supply Department. Supply of twelve 750-kVA transformers. (December 13th.)

London.—CENTRAL ELECTRICITY BOARD.—December 21st. Supply, delivery and erection of 132,000-V transformers for the Mid-East England Electricity Scheme, 1929. (November 22nd.)

January 6th. Supply, delivery, and erection of 132-kV overhead transmission lines (special crossings and high spans), for the North-West England and North Wales Electricity Scheme, 1928. (November 29th.)

January 20th. Supply, delivery and erection of 3,300-V, 6,600-V and 11,000-V switchgear for connecting the Board's supply to undertakers' busbars, North-West England and North Wales Scheme. (December 13th.)

ISLINGTON.—January 9th. St. Mary Parish Guardians. Supply and erection of five automatic electric lifts at the Infirmary, Highgate Hill, N. (December 6th.)

January 17th. Electrical and engineers' stores for one year commencing April 1st next. (December 13th.)

METROPOLITAN ASYLUMS BOARD.—January 2nd. Alterations to electric lighting installation at the South-Western Fever Hospital, London Road, Stockwell, and installation of car-washing and disinfecting apparatus at Brook, North-Western, South-Eastern and South-Western ambulance stations. (December 6th.)

January 2nd. Replating a 500-ampere-hour electrical storage battery at St. Luke's Hospital, Lowestoft. (December 13th.)

Lourenço Marques.—January 3rd. Tender Department of the Treasury. One oil-engine-driven d.c. generator and battery. (B.X. 5961.)*

Maidstone.—January 16th. Committee of Visitors. Electrical installation for lighting, heating, &c., at the Mental Hospital, Barming Heath. (See this issue.)

New Zealand.—WELLINGTON.—Post and Telegraph Department. January 13th. Four point jacks. (B.X. 5840.)*

January 16th. Telephone switchboard plug covers. (B.X. 5879.)*

January 21st. Spare parts for automatic telephones. (B.X. 5917.)* Reed-type tension gauges. (B.X. 5918.)*

January 27th. Breastplate transmitters. (B.X. 5956.)*

February 3rd. Protector blocks made of carbon and porcelain. (B.X. 5948).*

February 13th. Opal lamp caps. (B.X. 5955.)*

Public Works Department. January 14th. Two air compressors and two electric motors. (A.X. 8784.)*

January 28th. Three 50-kW oil-immersed circuit breakers for Arapuni. (B.X. 5878.)*

January 21st. Four electric motor-driven ventilating fans. (A.X. 8857.)*

South Africa.—BLOEMFONTEIN.—January 10th. Electricity Supply Department. Automatic electric traffic signals. (B.X. 5887.)*

JOHANNESBURG.—January 4th. Stores Department. Automatic traffic signals. (B.X. 5924.)*

CAPE TOWN.—January 7th. Electricity Department. Supply of 3-core 11,000-V cable. (B.X.5925.)*

Stoke-on-Trent.—December 31st. North-West Midlands Joint Electricity Authority. Supply and erection of e.h.p. and l.p. overhead transmission lines. (December 13th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Barnsley.—Borough Education Committee. Accepted:—
Electrical equipment of the grammar school laboratories (£240).—Corporation Electricity Department.

Carlisle.—Town Council. Accepted:—
Wiring 250 houses for electric light.—R. M. Hill & Sons.

Croydon.—Tramways Committee. Recommended:—
Spare motor for London service cars (£203).—General Electric Co., Ltd.
Electricity Committee. Recommended:—
Two 1,000-kVA transformers (£924).—British Electric Transformer Co., Ltd.
Sewage Committee. Recommended:—
Electric wiring at sewage works (£385).—J. & T. Robinson.

Dewsbury.—Town Council. Accepted:—
Cable (£2,035).—Power & Lighting Cables, Ltd.
It was stated that the difference in price between the British and German tenders was 12 per cent.

Glasgow.—Electricity Committee. Recommended:—
Two frequency changers (£572).—Macfarlane Engineering Co., Ltd.
Two reconstructed rotary convertors (£246) and nine motors (£1,062).—Metropolitan-Vickers Electrical Co., Ltd.
29 motors (£516).—Crompton Parkinson, Ltd.
24 motors (£269).—English Electric Co., Ltd.
Municipal Transport Committee. Recommended:—
Copper trolley wire (£1,204).—Felten & Guilleaume, per W. F. Dennis & Co.
Forged m.s. cable rings for subway.—Fullerton, Hodgart and Barclay.
Fishplates for subway rails.—Bolckow, Vaughan & Co., Ltd.
D.c.c. wire.—R. Johnson, Clapham & Morris, Ltd.
Conveyor plant parts for Pinkston.—North British Steel Foundry Co., Ltd.; Miller & Co., Ltd.; Lanarkshire Bolt Rivet Co., Ltd.; P. & W. MacLellan, Ltd.

Hastings.—Electricity Committee. Recommended:—
Overhead and underground cables to Battle. Schedule rates (total cost estimated at £7,435).—W. T. Glover and Co., Ltd. 5,000-kVA transformer (£1,495).—Ferranti, Ltd.

London.—CITY CORPORATION.—Health Committee.
Provision of electric lighting at crematorium buildings:—

W. J. FURZE & Co., LTD., (Recommended)	£563 0 0
Pinchin & Walton, Ltd.	588 10 0
Electrical Installations, Ltd.	596 14 2

EAST HAM.—Electricity Committee. Recommended:—
Control battery and switchboard (£265).—Hart Accumulator Co., Ltd.

Rotherham.—Electricity Committee. Recommended:—
2,600 yd. of 0.1 in. three-core e.h.p. cable (£1,352) and 1,200 yd. ditto (£620).—Callender's Cable and Construction Co., Ltd.
Two pairs 10.000-kVA, 6,600 V-type switches, £256 per pair plus £9 11s. 3d. per switch for automatic control; one 3,300-V switch equipment (£303) and one l.p. switch equipment (£228).—A. Reyrolle & Co., Ltd.
Two oil switches and meter panel (£249) and one 450-h.p. and one 110-h.p. a.c. motors (£630).—British Thomson-Houston Co., Ltd.

Sowerby Bridge.—Urban Council. Accepted:—
Electrical work at houses at Beechwood.—J. Harrison and Co. (Halifax).

Stoke-on-Trent.—Education Committee. Accepted:—
Electric kiln at the Burslem School of Art (£110).—R. M. Catterson-Smith.

Forthcoming Events.

British Electrical Development Association.—Friday, December 20th. Royal Society of Arts, John Street, Adelphi, W.C. 7.30 p.m. Display of propaganda kinematograph films.

Birmingham Electric Club.—Friday, December 20th. Grand Hotel, Birmingham. 7 p.m. Annual meeting.

Salford Technical and Engineering Association.—Thursday, December 26th. Royal Technical College, Salford. Annual social.

Institution of Electrical Engineers (Meter and Instrument Section).—Friday, January 3rd. Savoy Place, Victoria Embankment, W.C., 7 p.m. "Instrument Transformers." Mr. J. G. Wellings and Mr. C. G. Mayo.

Institution of Mechanical Engineers.—Friday, January 3rd. Institution, Storey's Gate, S.W., 6 p.m. Thomas Lowe Gray Lecture: "Progress in Marine Engineering." Eng.-Vice-Admiral R. W. Skelton.

Junior Institution of Engineers.—Friday, January 3rd. 39, Victoria Street, S.W., 7.30 p.m. "Speedy Draughtmanship." Mr. F. T. Woods.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of makers of the following:—

DONOVAC vacuum cleaners.
VIVOS vacuum cleaners.
GRAYBAR stimulators (agents for).

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Notes.

Manchester Electrical Engineers' Dance.

This very popular annual gathering took place at the Midland Hotel, Manchester, on Friday last, some 230 guests being present. In accordance with the Manchester tradition, a cabaret show added to the enjoyment of the evening, the acrobatic dancers and roller skate exponents being so skilful as to challenge to the utmost the feats of the ordinary dancers. Among those present, and full of activity, were Col. Cortez-Leigh, Messrs. S. E. Fedden, H. C. Lamb, L. Romero, A. McKinstry, P. N. Rand, and R. S. Pilcher.

An excellent band (the Midland Hotel orchestra) and the distribution of balloons and favours all helped to provide the usual delightful entertainment, on which Mr. C. D. Taite, Mr. Harcourt Williams, and the executive committee may once again be most heartily congratulated.

Protection Against Lightning.

The United States Bureau of Standards has issued a report (Miscellaneous Publication No. 95) dealing with the application of lightning arrestors to electrical lines and equipment. The report has been drawn up by a committee representing the various technical societies and others concerned with the subject. The protection of power, railway, signalling, and communication circuits and apparatus is described; the bulk of the report deals with the application of lightning arrestors to power and railway circuits, but other methods of protection, such as the use of overhead ground wires, are also discussed, and the report points out how a proper selection and application of arrestors will greatly reduce trouble and avoid frequent interruptions of service. The Bureau emphasises the fact that it is only a preliminary report, and comments and suggestions from those interested will be welcomed. The investigation of the properties of lightning is now being carried out more intensively than ever before, and it is expected that within a short time our knowledge of lighting and of the methods of combating its effects will be greatly increased.

An Improved Petrol-electric Vehicle.

The TS17A-type petrol-electric chassis, suitable for double-deck 'bus bodywork of about 52 passenger-seating capacity, exhibited by Messrs. Tilling-Stevens Motors, Ltd., at the recent Commercial Motor Show at Olympia, was of an improved type. Fitted with a 4-cylinder 36/95-h.p. engine, the first of these vehicles is at present in regular London service, and the newcomer marks a considerable advance, as compared with its predecessors. The main problem has been to produce a machine of the capacity stated that would come within the maximum laden weight of 9 tons specified by Ministry of Transport Regulations for four-wheel passenger vehicles. When the considerably heavier weight of the electrical units, as compared with the ordinary clutch and gear box, is taken into account, it will be realised that to have done so is a remarkable achievement. It has been accomplished mainly by constructing many parts of "Elektron," aluminium, and duralumin in place of heavier metals formerly used. "Elektron" has a tensile strength equal to that of aluminium, though it is 40 per cent. lighter, and it needs special caution in machining operations as, owing to its magnesium content, the turnings are liable to become incandescent unless quenched with lubricant.

During a series of tests carried out by the makers, the new machine, with a gross laden weight of 9 tons, could be moved on the level with the engine turning at 380 r.p.m., and for a quick start it does not rise above 1,500 r.p.m. The acceleration figures obtained were:—

Seconds.	m.p.h.	Seconds.	m.p.h.
5 ...	... 13.75	30 ...	... 29.75
10 ...	... 18.5	35 ...	... 30.87
20 ...	... 24.25	40 ...	... 31.75
25 ...	... 27.25		

The rates of acceleration at the lower speeds are exceptionally creditable, and would be very difficult to equal with a gear-driven vehicle, particularly in view of the time ordinarily occupied in changing gear. The value of such an accomplishment under 'bus service conditions need not be emphasised.

Electric Shock Fatalities in Australia.

In connection with the revision of the Electric Wiring Regulations in which the Standards Association of Australia is engaged, information was sought concerning the number and causes of electrical fatalities in each State of the Commonwealth. According to the *Industrial Australian and Mining Standard* the inquiry elicited the fact that the number of deaths in Australia due to this cause is approaching 50 per annum, the total in 1927 having been 46. Most of the accidents resulted from unearthed conduit and defective flexibles, and sometimes badly wired lamp sockets; these defects are due sometimes to faulty workmanship, but more often to the ignorance or carelessness of the persons handling the apparatus. It is stated on reliable authority that the number of deaths from electric shock in the U.S.A. does not exceed one per million of the population per annum, against seven to eight per million in Australia.

Railway Electrification.

The Committee on Electrification of Steam Railroads of the National Electric Light Association (U.S.A.) has recently issued its annual report. ($1.15.)

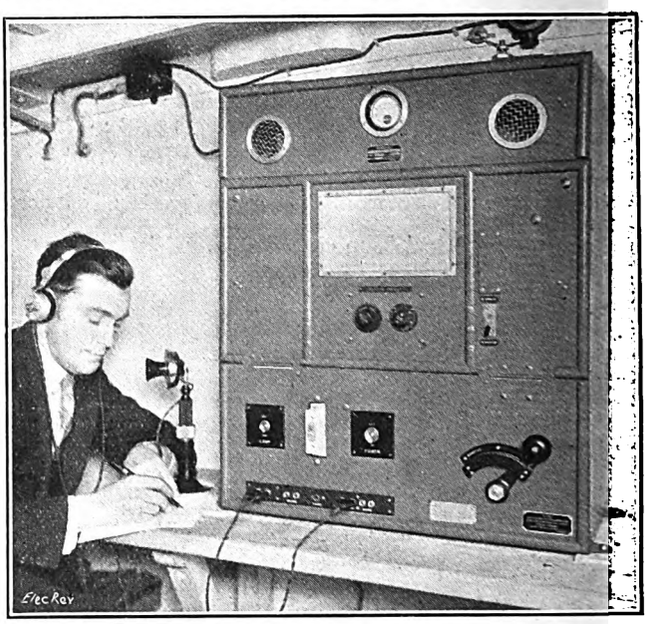
This report is of more than usual interest in that it summarises the leading particulars of electrified railways throughout the world, giving information as to mileage, systems, and reasons for and results of the change over. Appendices include a comprehensive study of railway electrification in Europe (containing a large number of good illustrations), recommendations in regard to the features which should be inserted in railway power contracts, and statements by railway presidents as to the present trends in practice.

Thawing Water Pipes by Electricity.

For more than twenty-five years the thawing of pipes by electricity has been known in Switzerland, but it was only during the intense cold of the first three months of 1929 that a truly practical method of coping with such conditions was evolved. The Entreprises Electriques Fribourgeoises have installed an electric thawing installation in dozens of private water-supplies in Fribourg, Moudon, Payerne, Schwarzenbourg, &c., much to the advantage of householders. The installation consists of a transformer which reduces the voltage of the house supply to that requisite. The two terminals are connected to the two ends of the section that is in need of thawing, whether it be in the house itself or between two houses. The current is then switched on, and very shortly the water is thawed, and all danger of a burst pipe eliminated, as well as the unwelcome visit of a plumber.

Lifeboat Wireless-Telephony.

Reproduced herewith is a photograph of the wireless outfit of the new Dover lifeboat which, with its two 375-h.p. engines, is the fastest lifeboat in the world, and has been specially designed for the rescue of people from aeroplanes which may fall into the sea. Included in its equipment is a special type



of Marconi wireless telephone set for communicating with aircraft, aerodrome, ships, and coastal wireless stations. It is a totally-enclosed installation, known as the type XMB.1, designed for use under the roughest conditions, and normally will work with a transmitting power of 100 watts on a wavelength of 900 metres.

B.S.S. for Bare Annealed Copper Wire.

A revision of British Standard Specification No. 128 has just been issued, and it is intended to meet the needs of users of bare annealed high-conductivity copper wire for winding electrical machinery and apparatus. One of the principal differences between the new and the 1922 editions is that the tolerances permitted on the resistivity of the copper and on the diameter of the wire are smaller in the new edition. A further difference between the new and the old editions is that in the latter specification the tables showed the standard resistance corresponding to the standard maximum and minimum permissible diameters of the wires, whereas the tables in the new specification give the standard resistances of a wire of standard diameter and show the *actual* maximum and minimum permissible resistances of all wires, irrespective of the variation in diameter from the standard diameter within the tolerance provided. In other words, the maximum and minimum resistances take account of both the tolerance on specific resistance of copper and the tolerance on standard diameter of wire, no further tolerance therefore being allowed on the values given in the tables of the specification.

Copies of the new specification, No. 128, 1929, may be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria Street, S.W.1, price 2s. 2d., post free.

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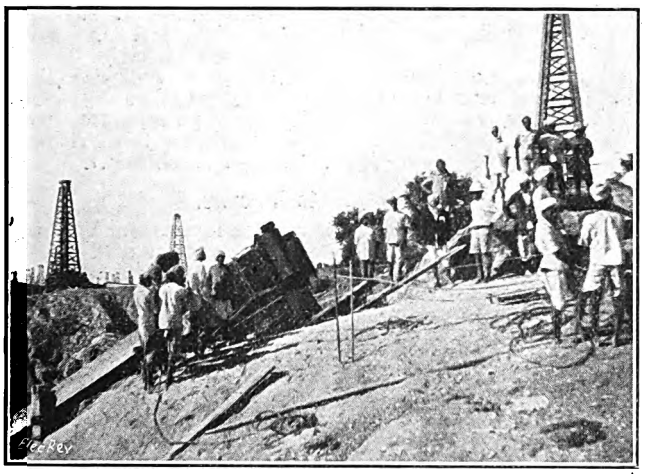
Electric Vehicles in France.

Coincident with the development of motor vehicles equipped with generators for the production of producer gas as a substitute for petrol for the engines, considerable progress is being made in France in the use of electric vehicles. In Paris the Société des Vehicules Electriques Industriels Sovel has recently taken a financial interest in the Compagnie des Camions Electriques, which has opened a large garage and service station near the Nord and Est railway goods yard, where not only can electric vans and lorries be garaged, but batteries charged also, and all necessary repairs undertaken. A vehicle maintenance system is also in operation, while a fleet of vehicles is kept for hiring purposes. Similar work is being done in Lyons by the Société Lyonnaise pour l'Exploitation de Vehicules Electriques, where such progress has been made that the first garage for forty vehicles is now so fully occupied that a second establishment for 100 vehicles is about to be opened. At Strasburg, too, there has lately been formed the title La Société Alsacienne de Vehicules Electriques, the purpose of which is to establish similar enterprises in Strasburg and Mulhouse.

Electrical Equipment for Oilfields.

Not only is oil-well pumping equipment subject to onerous conditions of service, but the location of the oil-fields themselves is often also such that the transport of machinery to the site is particularly arduous, as may be noted from the accompanying illustration, which shows a stage in the transport of a



B.T.-H. motor-control unit to a large oil-field in Burmah. It is interesting to mention that, in addition to many electric motors and control equipments for duty in oil-fields, the British Thomson-Houston Co., Ltd., has manufactured steam-turbine plant, switchgear, &c., of special design to meet the prevailing conditions.

A Large Welded Condenser.

What is said to be the first large all-welded surface condenser for a stationary power plant is now in operation in the Parr Shoals station of the Broad River Power Company at Parr, S.C. This condenser, having 27,000 sq. ft. of condensing surface and serving a 30,000-kW turbine, went into regular operation on September 10th, and has since been giving entire satisfaction.

A study of European condenser design and of marine practice over the past twenty years reinforced preliminary impressions that by substituting welded construction for cast-iron, some saving would be made in first cost, and that a substantial reduction in air leakage would be effected.

The question of weight influenced the decision for a welded condenser in two ways: first, by cutting down the initial cost, and, secondly, by making more feasible a special suspended construction to keep clear the floor space beneath the condenser. The steel used for the shell of the condenser is 7/16 in. thick, whereas the corresponding cast-iron thickness would have been of the order of 1¼ or 1½ in. To guard against corrosion it was decided to build the condenser of copper-bearing steel. All joints in the sheet itself are double V-butt welds. All welds were made by the stable-arc process.

Copper-bearing iron was used for the tube plates. The tube plates are 1¼ in. thick, the tubes having an outside diameter of ¾ in (17 gauge). The tubes, of Admiralty metal, were ordered with the inlet ends rounded to approximately ⅜ in. radius, the inlet tube plate being machined at the tube holes to fit this curvature. After the tubes were in place they were rolled inside their cylindrical contacts.

The construction of the shell is similar to that employed in shipbuilding. Butt joints are reinforced with T-bars (5×5 in.) both inside and out. The inside bars, as may be seen from the drawing, run up and down, while those outside run longitudinally.

The vacuum obtained ranges from 28.4 in. to 28.05 in. for water inlet temperatures of 85 deg. Temperatures obtained at the turbine exhaust and in the condensate, differ by amounts varying from zero to 2.4 deg. F. It is believed that the rolling of the tubes in the tube plates, together with the use of welded construction, are largely responsible for the low air leakage indicated.

Electricity on Board Ship.

In his presidential address to the Institute of Marine Engineers, Engineer Vice-Admiral Sir Robert B. Dixon, K.C.B., D.Eng. (retired: Engineer-in-Chief of the Fleet from 1922 to 1928) dealt generally with the development and trend of marine engineering during the last few years, which, until fairly recently, was generally very conservative. Although the Navy was probably the first user (*viz.*, in submarines) the mercantile marine was the first to adopt the heavy-oil engine for surface ship propulsion, and the rapid rate of development of the turbine for marine use was facilitated by the design policy of the British Admiralty. Since the war the oil engine had challenged the supremacy of the steam engine with no uncertain voice, and severe competition had stimulated the development of the steam engine in several directions. It appeared that there was no possibility of any striking improvement in the efficiency of the Diesel-engine cycle, and economies which might be effected must be obtained outside the engine cycle proper; for example, by the utilisation of waste heat, so that sufficient steam could be generated to drive some of the auxiliary engines direct, or to drive turbo-generators which generated electricity for motor-driven auxiliary machinery, or to distil fresh water. The utilisation of the exhaust gases in a waste-heat boiler in that manner probably increased the overall efficiency of the machinery installation by four to five per cent. The cost of driving auxiliary machinery might become considerable, and there were as many alternatives as of designs of main engines, so that it was difficult to point to any particular method as offering an outstanding overall advantage. One noticeable development, however, was the wider use of electrically-driven auxiliaries, and, taking everything into account, he was of the opinion that the advantages of that system were such that in mercantile marine machinery in the future the use of electrical appliances would be considerably extended.

For providing power for liners, steam machinery was far ahead of the oil engine as regarded reliability and efficiency; the full possibilities of the steam cycle had yet to be realised, and he was inclined to think that the steam cycle would hold its own for most ships operating under conditions other than those specially favourable to the oil engine, particularly for passenger liners.

One of the desirable virtues in propelling machinery was flexibility; he believed it was that consideration which had led to the extended use of the electric drive, both for turbine and Diesel machinery. The electric drive was more suitable for turbine than Diesel machinery, because the rotating masses of high-speed turbines and generators presented no serious balancing problems such as must be faced with high-speed reciprocating masses involved by Diesel machinery in large ships, and the comparative freedom from vibration with the turbine type of machinery was a very big asset.

The chief advantage claimed for electric propulsion was that the power-generating machinery was separated mechanically from the propelling machinery, so that one or more generating units could be used to generate power for the whole of the propelling machinery. By that means the ship, when service conditions rendered it possible to close down a section of the generating plant, could be operated more economically at low powers than with the direct drive, and reserve power could be provided to operate at an economical rate. The system permitted the turbines being run at the highest possible speeds consistent with the output for which they were designed, and a high steam efficiency was thereby obtained, but against high-efficiency must be off-set the relatively lower efficiency of the transmission. In his opinion that method of transmitting the propelling power was more costly and less efficient than transmitting it through well designed gearing.

"Talkie" Film Apparatus.

The British Thomson-Houston Co., Ltd., is reported to be undertaking the production of "talkie" apparatus, one of the first of which is to be installed at the Globe Picture Theatre, Coventry. The equipment caters for both film and disk record reproduction, and is designed for operation from the mains by means of a directly-coupled motor-generator having three separate generators. For sound-on-film reproduction an improvement is claimed in the use of a new element for the photo-electric cell, and one valve only is used in the first amplifier mounted on the projector. A feature is the provision of spare lamps mounted so that they can be instantly replaced. A special form of contant-speed motor has been evolved which ensures maintaining correct musical pitch; it drives directly the turn-table, and, through a gearbox and silent chain, the projector. The speakers used are of the electro-dynamic type, the fields being excited off the motor generator. The frequency curve of the amplifier and speakers is stated to be exceptionally good.

Television.

Dr. Vladimir Zworykin, research engineer of the Westinghouse Electric & Manufacturing Co., has made a device which receives moving pictures transmitted by wireless, and reveals them upon a cathode-ray tube which takes the place of the existing glow valve, scanning disk, and motor, and is said to be easily attached to any receiving set. It is a cone-shaped tube with a flat end, upon which the transmitted moving picture appears. Dr. Zworykin admits that his device lacks perfection, but he declared that visual broadcasts synchronised with sound would become commonplace.

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The Drumm Battery.

Considerable interest continues to be shown in the secondary battery invented by Mr James Drumm, of Dublin, which is being financially backed by the Irish Free State Government. No particulars of the new battery are available, for, although a search at the British patent office shows that so far this year no fewer than seven applications in respect of storage batteries have been filed by Mr. Drumm, none has so far reached the stage of the issue of either a provisional, or complete, specification.

A Large Hydro-Electric Development.

On October 12th last work was commenced at Beauharnois, Quebec, on the construction of one of the world's largest engineering projects, including the erection of a hydro-electric generating station. The Beauharnois Power Corporation has secured authority from the Provincial Government of Quebec and from the Dominion Government for the construction of a power and navigation canal taking water from the River St. Lawrence at a point close to Valleyfield, on Lake St. Francis, and débouching into Lake St. Louis lower down the river, about 18 miles away. The length of the canal itself will be about 15½ miles. The power house, which will be erected on the banks of Lake St. Louis, will be half a mile long and 95 ft. in height, with accommodation for 50,000-h.p. generators spaced at about 68 ft. apart. The plant will utilise a drop in water level of 83 ft., and in the four rapids intervening between the two lakes there is a total flow of about 200,000 cu. ft. per sec. The company has drawn up plans for an initial installation of 500,000 h.p., having been permitted to withdraw up to 40,000 cu. ft. per sec. at the outset of its operations. The first step in the construction will be provision for the generation of 200,000 h.p. to be marketed by October, 1932. The company is of opinion, however, that there would be no difficulty in producing up to 350,000 by that date if it were found necessary to to do so, and it is reported that negotiations are proceeding between the promoters and the Hydro-Electric Power Commission of Ontario for the conclusion of a contract for the supply in Ontario of 250,000 h.p. to meet the industrial development of the eastern districts of that province. After the provision of the first installation of 500,000 h.p., the expansion of the plant to its designed capacity of 2,000,000 h.p. will await the demands of industry in the vicinity. The cost of the navigation canal itself will be $15,000,000, with annual charges of about $1,000,000. The cost of the initial installation of 500,000 h.p., including the canal, power house, control works, generators, and complete electrical installation is estimated at $65,000,000, or $130 per h.p. A further development to 700,000 h.p. is placed at $106 per h.p. and an ultimate development of 2,000,000 h.p. as low as $50 per h.p.

Women and Electrical Engineering.

The head of the year in the Electrical Engineering Department of the Birmingham University was a girl, said Prof. W. Cramp, speaking at the recent annual dinner at Birmingham of the Midland Branch of the Junior Institution of Engineers. Not only so, the *Birmingham Post* reports him as adding, but she was also a head and shoulders above any of the men in originality, persistence, and patience, which showed that the thin edge of the wedge was being driven home with force. Women had a rôle to fill, especially in electrical engineering, which could not be adequately filled by men. He hoped to see more of them entering the profession.

Racecourse Totalisators.

The statement which Lord Hamilton of Dalzell (a representative of the Jockey Club on Racecourse Betting Control Board and chairman of the committee appointed to pilot through Parliament the Bill that was to legalise pool-betting on British horse-race courses) recently made to his fellow-members of the Club was explanatory of the Board's policy relative to its use of automatic electro-mechanical totalisators, but it did not indicate why several installations that were planned to be ready for this autumn's meetings will not be in use this year. His remarks about the "degree of portability necessary for the equipping of a large number of racecourses" are of interest, since electrical operation is essential, hand operation being too slow for the volume of business to be done. However, most English race courses are somewhat remotely situated from sources of electricity supply; moreover, the laying of cables or the installation of local generating plant, would be uneconomical, as the totalisators function for only a few days each season. The use of batteries of accumulators has accordingly been resorted to. Three separate 2-volt cells are assembled in a crate, 18 sets of such crates comprising a "tote" battery of 54 cells in all, the whole being of very robust construction. They are mounted on specially adapted motor lorries, together with a swichboard and other necessary auxiliary apparatus, and thus transported from place to place and stationed at the rear of the machine, where they do their work silently and efficiently. Batteries are allocated to different districts, and are moved from one racecourse to another as required. The first six batteries supplied by the D.P. Battery Co., Ltd., have each an output of 500 ampere-hours at 100 volts, and are of the "Kathanode" type. The systems employed differ slightly in detail, but with the full automatic equipment the pressure of a key on one of the numerous machines installed at the selling stations on different parts of the ground will print and deliver tickets and automatically register the bets on a centrally situated adding machine, which, in turn, will cause the figures to appear on the indicator board in full view of the public. One type of indicator is worked on the principle of electric signs, and over 8,000 lamps are used to form the different figures. The "Kathanode" battery supplies the necessary current, besides operating signalling and other devices.

A new portable Ericsson totalisator will shortly be tested on a racecourse near London with a view to getting it approved by the Racecourse Betting Control Board. It is stated that it is the only portable electrical totalisator in the world, and that it involves little preparation for installing. It is not necessary for the frames to be permanently erected, and the only preliminary work is the laying of the cables. The remainder of the apparatus can be moved from course to course.

Lectures on Synthetic Resins.

A course of lectures will be held at the Borough Polytechnic Institute on Wednesdays (7.30 to 8.30 p.m.), commencing January 22nd, on the subject of "Synthetic Resins, Moulding Powders and Plastics. The lecturers are men actively engaged in the manufacture or use of the different types of resins and plastics, and they will deal with the manufacture, properties, uses and future possibilities of the products. The first six lectures will be: Thiourea-formaldehyde Resins, Mr. A. V. Keller, F.C.S.; Phenol-formaldehyde Resins, Mr. H. V. Potter, B.Sc.; Casein Plastics, Mr. R. Dodd, B.Sc.; Nitro-cellulose and Cellulose Acetate Plastics, Mr. J. E. Beard; Methods of Moulding, Moulds and Moulding Machinery, Mr. A. V. Keller, F.C.S.; and Liquid Cements and Binders, Mr. J. Taylor, B.Sc. Dates and lecturers will be announced later for lectures on Coumarone and Indene Resins, Glyptals, Artificial Glass, &c. The fees for the course are 10s. for London students under 18 and £1 for London students over 18. Applications for forms and further particulars should be made to the Principal, Borough Polytechnic Institute, Borough Road, S.E.1.

Appointments Vacant.

Plumber cable jointer and meter tester repairer for Workington Corporation. Engineer for the development of the showroom and use of electricity, for Chester City Council. Chargehand plumber cable-jointer for Eccles Corporation. (See our advertisement pages to-day.)

Institution Notes.

Institution of Electrical Engineers.

INFORMAL MEETING.—At the informal meeting of the Institution on December 9th, a discussion was opened by Messrs. W. R. Rawlings and T. C. Gilbert from opposing points of view on the perennial question of whether "to earth or not to earth." The importance of the subject attracted a very large and representative gathering, and the views expressed showed that the subject, despite the official stipulation, is as moot as ever. Mr. W. E. Bradshaw was in the chair.

Mr. Rawlings entirely agreed that the subject needed the fullest publicity. He felt that the Press notices of the last discussion did a great and valuable service to the industry in bringing home the importance of safeguarding the public against the possible dangers of alternating current at 230 volts. He thought it must all result in a definite call for better materials and workmanship. To insulate was best, but he had still to learn how it could be effectively done. Until motors, cookers, radiators, fans, irons, kettles, &c., could be made of insulating material, he believed there could only be one course, namely, to earth. He was fully aware that the present method of earthing had flaws and was misleading, but he pressed for general and stricter observance of the practice. He advocated earthed concentric wiring as providing a safe system which intimated any leakage by automatically cutting off supply to the affected section.

Mr. T. C. Gilbert said that, if only a fraction of the time and energy spent in advocating the earthing of all exposed metal had been given to the consideration of ways and means of eliminating such metal, they would to-day be in a much sounder position. The earthing idea seemed delightfully simple, but its application to domestic portable apparatus was so remote from good practice that only legislation could enforce it. If after thirty years the practical man was still unconvinced, surely there must be good reason to suspect that the idea was unsound. He agreed that very great harm was done to the industry by electrical accidents, and said that means must be found to reduce the risks in view of the forthcoming universal a.c. supply, but he held that earthing was unworthy of being the sole reply of the industry to the menace confronting unskilled users of electrical apparatus. There were too many weak links in the chain. With universally-earthed equipment it would not be necessary for victims to get into baths, or connect themselves to earth by similar means, as a convenient earth would always be at hand. Recently he found a child poking the metal handle of a toy into the element of a radiator; luckily the latter had not been earthed and so a serious accident was avoided. In the case of some of the newer cookers, it was extremely difficult to obtain a

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shock, owing to the thick coating of vitreous enamel with which they were covered. That was a step in the right direction, but there might be very high insulation between the boiling plate and the hob, and he could not repress a shudder when he thought of kettles, &c., used in proximity to that mass of earthed metal. No domestic appliance in use to-day could not be constructed of material other than metal, or, alternatively, could not be effectively insulated.

Dr. A. Ekstrom said that earthing was a very dangerous practice to introduce into houses, because of the false sense of security. If one could not rely on it, one was better without it, while in rural wiring it was very difficult, or impossible, to find an earth of sufficiently low resistance. If only the handles of irons and kettles were better insulated than at present, a very great improvement would be effected. It was also desirable to insulate the knobs of water taps, because they were firmly gripped.

Mr. S. W. Melsom was sorry that the advocates of earthing had confined their proposal to a dubious concentric wiring system. Could anyone doubt that the real solution was to insulate all apparatus? There was too much inclination to neglect the more reliable method of using the very best dielectric.

Mr. F. E. Phillips said that, while tough-rubber-insulated cables originated for use as colliery trailing cables, their use had been extended to all purposes. Government Departments used them largely, and innumerable important buildings had been so wired. Such cables could be exposed to the atmosphere or concealed at will. They withstood moisture and provided the ideal insulated system.

Messrs. C. J. Banister, A. J. Bousfield, W. E. Bradshaw, A. H. Dykes, A. Edwards, H. Willoughby Ellis, A. F. Harmer, B. Higgs, W. E. Lang, A. Morgan, W. A. Ritchie, E. S. Ritter, A. J. Stiling, and D. J. Watkins also spoke.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

The Sunderland Town Council has appointed Mr. A. B. McLEAN, of Newcastle-on-Tyne, as chief assistant in the Electricity Department, to fill the vacancy caused by the appointment of Mr. W. A. Royle, as borough electrical engineer of Blackburn, at a commencing salary of £700, rising to £800 a year. An amendment to refer the matter back to the Electricity Committee on the ground that the post had not been advertised was defeated.

Capt. J. W. BARBER has been elected chairman of the Radio Manufacturers' Association and Mr. R. M. ELLIS vice-chairman.

Mr. GEORGE TOUGH, O.B.E., M.I.E.E., manager of the Coventry Corporation Electricity Department, is retiring upon superannuation in April next. He was appointed mechanical assistant at the Corporation's electricity works in 1899 and manager in 1908. When he first went to Coventry the station had a capacity of 350 kW with 150 consumers; to-day the capacity is 70,000 kW with 21,291 consumers. Mr. Tough was responsible for the plans and supervision of the erection, specification, and equipment of the new Longford station, which forms part of the national grid scheme and was recently opened.

Mr. R. H. RAWLL, A.M.I.E.E., district installation engineer, Birmingham Corporation Electric Supply Department, has been appointed assistant to Mr. G. Rogers, M.I.E.E., who is in charge of the frequency change-over in Birmingham.

Obituary.—Mr. S. FERRIS.—The death has taken place suddenly, at the age of 65 years, of Mr. Shadrach Ferris, who was in business as an electrical engineer at Swindon. At the age of five years he lost his sight, but after being educated at blind schools at Bath and London, he went to Swindon, attended evening classes at the Technical Institute, and obtained the City and Guilds certificates in electrical engineering. He had resided in the town for about 30 years.

HERR A. V. ZELEWSKI.—The death recently occurred in Berlin, at the age of 53 years, of Herr A. V. Zelewski, the chief engineer of the A.E.G. transformer works. The deceased, who was born in Rome, Italy, was an authority on transformer design and construction, and has left the manuscript of an unfinished book on the subject.

MR. A. J. HUBER.—We hear with regret of the sudden death at Hayes of Mr. A. J. Huber. After severing his Continental associations, Mr. Huber was on the staff of Messrs. Ferranti, Ltd., Hollinwood, which appointment he relinquished in 1920 to join the British Electric Transformer Co., Ltd., taking charge of their export work. Mr. Huber was 51 years of age.

SIR HENRY JACKSON.—The death occurred on Saturday last of Admiral of the Fleet Sir Henry Bradwardine Jackson, who not only rose to high naval rank but was a scientist of considerable attainments. Sir Henry was born in 1855; he entered the Navy at an early age and reached flag rank in 1906. In the meantime he had read a paper before the Royal Society in "Some Phenomena Affecting the Transmission of Electric Waves over the Surface of the Sea," and in 1901 he was elected a Fellow of the Society in recognition of his research and development work in connection with wireless communication. He had met Marconi in 1896 and assisted and supported him in his work, although the Admiralty rejected Marconi's offer of the use of his patents on account of the supposed danger of the ignition of the magazines by wireless waves. He introduced a rudimentary system of radio communication while serving with the Mediterranean Fleet in 1901 and later he developed a more satisfactory arrangement while commanding a torpedo-school ship at Devonport. He continued his activities until his promotion to flag rank and several years after, in 1920, he became chairman of the Radio Research Board, a position which he held until this year. His energies were not, however, devoted solely to radio work; in many other branches of naval science (particularly in torpedo development) he was an acknowledged authority. During the war he held a number of special posts and he was appointed First Sea Lord when Lord Fisher retired in 1915. He held this position for about eighteen months and finally retired from the Navy in 1924. Sir Henry was a

Elliott & Fry] *[London.*

The late Admiral of the Fleet Sir Henry Jackson, F.R.S.

Knight Grand Cross of the Order of the Bath and a Knight Commander of the Victorian Order; he held honorary doctorates of Oxford, Cambridge and Leeds Universities; and became an associate member of the Institution of Electrical Engineers in 1883 and had been a member since 1902.

Will.—Mr. J. S. THOMSON, of Dunfermline, manager of the Fife Electric Power Co., left £6,043.

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Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Tom B. Wilkinson, Ltd.—Private company. Registered December 9th. Capital, £100 in £1 shares. Objects:—To carry on the business of electricians, electrical engineers and contractors, mechanical and general engineers, cabinet makers and furniture dealers, workers and dealers in gramophones, wireless sets, &c. The directors are:—O. W. Porritt, Torside, Helmshore, Lancs. (director, Porritts & Spencer, Ltd.), T. B. Wilkinson, Arnside, Westmorland. Registered office:—Arnside, Westmoreland.

Lancashire Electric Sign Construction Co., Ltd.—Private company. Registered December 11th. Capital, £1,000 in £1 shares. Objects: To acquire from W. Donegani, the inventor and patentee, his invention called the "Controlagraph," and to carry on the business of advertising contractors, sign-writers, suppliers of and dealers in electrical, luminous, and other signs, signalling apparatus, and component parts and accessories, &c. The first directors are:—J. F. W. Johnson, 15, King Street, Covent Garden, W.C., manufacturer; H. Walmsley, 476, Edge Lane, Droylesden, Lancs., manufacturer. Qualification, £50. Solicitors: Robert B. Batty & Co., 4, Clarence Street, Manchester.

Wm. E. Culkin & Co., Ltd.—Private company. Registered December 6th. Capital, £1,000 in £1 shares. Objects: To carry on the business of electrical, mechanical and automobile engineers, haulage contractors, suppliers and distributors of electricity, proprietors and managers of telegraph, telephone and signalling works, manufacturers of generators, motors, dynamos, lamps, accumulators, radiators, vacuum cleaners, wireless receivers, &c. The first directors are:—F. Sowden, 37, Hampden Street, Bradford, clerk; Edith M. Wood, 117, Camp Road, Leeds, secretary. Qualification, £50. Registered office: Neville Street, Leeds.

Low Pressure Lamps, Ltd.—Private company. Registered December 10th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in low pressure and all other forms of electric, incandescent or other lamps, arc lamps and lighting apparatus of all kinds, &c. The subscribers (each with one share) are: A. L. Howard and P. S. Hicks, 36, New Broad Street, E.C.2, solicitors' clerks. The first directors are not named. Secretary: F. S. Bullard. Registered office: 36, New Broad Street, E.C.2.

Swindon Radio Relay Exchange, Ltd.—Private company. Registered December 12th. Capital, £2,300 in 2,000 shares of £1 each and 6,000 shares of 1s. each. Objects: To construct and maintain wireless signal stations for the reception and distribution of wireless or radio signals or waves, &c. The directors are: J. F. Powell, 34, Wellesley Road, Clacton-on-Sea (director Broadcast Relay Service, Ltd.), A. W. Brown, 80, Goddard Avenue, Swindon, secretary of Co-operative Society; J. W. C. Robinson (managing director), The Cottage, Lancaster Gardens, Clacton-on-Sea (director Broadcast Relay Service, Ltd.). Qualification: £250 shares. Registered office: 14, Victoria Road, Swindon.

Official Returns of Electrical Companies.

Young, Osmond & Young, Ltd.—Capital, £18,000 in 17,500 preference and 500 ordinary shares of £1 each. Return dated August 13th, 1929. 17,500 preference and 45 ordinary shares taken up. £17,545 paid. Mortgages and charges at date of return: £1,500. Since registered: Deposit of deeds dated September 28th, 1929, to secure all moneys, not exceeding £7,000.

John Phillipson & Co., Ltd.—Capital, £500 in £1 shares. Return dated August 14th, 1929. All shares taken up. £500 paid. Mortgages and charges: nil.

Eastern Extension, Australasia & China Telegraph Co., Ltd.—Capital, £4,000,000 in £10 shares. Return dated June 12th, 1929. All shares taken up. £4,000,000 paid. Mortgages and charges: £752,400.

Lithanode Co., Ltd.—Capital, £3,000 in £1 shares. Return dated July 10th, 1929. 2,327 shares taken up. £627 paid. £1,700 considered as paid. Mortgages and charges: £2,900.

Wallingford & District Electric Supply Co., Ltd.—Capital, £13,000 in £1 shares. Return dated May 22nd (filed July 12th), 1929. All shares taken up. £13,000 paid. Mortgages and charges: £3,592 6s. 7d.

Pettigrew & Merriman (Continental), Ltd.—Capital, £3,000 in £1 shares. Return dated September 13th, 1929. All shares taken up. £3,000 paid. Mortgages and charges: nil.

Mirrlees, Bickerton & Day, Ltd.—Capital, £600,000 in 100,000 5½ per cent. cumulative preference and 500,000 ordinary shares of £1 each. Return dated July 5th, 1929. 71,000 preference and 466,000 ordinary shares taken up. £302,500 paid on 71,000 preference and 231,500 ordinary shares. £234,500 considered as paid on 234,500 ordinary shares. Mortgages and charges: nil.

Europe & Azores Telegraph Co., Ltd.—Capital, £200,000 in £10 shares. Return dated September 11th, 1929. All shares taken up. £144,320 paid. £55,680 considered as paid. Mortgages and charges: nil.

Ashton Electrical Co. (Preston), Ltd.—Capital, £1,500 in 250 founders' and 1,250 ordinary shares of £1 each. Return dated July 10th, 1929. All shares taken up. £1,350 paid on 1,100 ordinary and 250 founders' shares. £150 considered as paid on 150 ordinary shares. Mortgages and charges: nil.

Dubilier Condenser Co. (1925), Ltd.—Capital, £500,000 in 250,000 preference shares of £1 each and 500,000 ordinary shares of 10s. each. Return dated July 24th, 1929. 200,000 preference and 426,250 ordinary shares taken up. £413,125 paid. Mortgages and charges: nil.

Ridged Cone Co. Ltd.—Particulars filed of £800 debentures authorised November 30th, 1929, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Hewittic Electric Co., Ltd.—Satisfaction in full on October 30th, 1929, of debentures authorised October 27th, and registered November 1st, 1927, securing £10,000.

Garnett, Whiteley & Co., Ltd.—Debenture dated November 29th, 1929, to secure £7,350, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. K. Bulley, Ness, Neston, Ches.

Electro Dynamic Construction Co., Ltd.—Satisfaction to the extent of £1,000 on November 7th, 1929, of four of a series of six debentures of £250 each, authorised October 22nd, and registered October 28th, 1924.

City Notes.

Burma Electric Supply Co., Ltd.

The annual meeting of this company was held on December 11th, Mr. C. O. Webb (chairman) presiding. In presenting the report and accounts the chairman said that during the past year considerable progress had been made in the change over from 500 V to 250 V. The increase in receipts was due to increased sales and not to the alteration in the rates on the change-over. Regarding the tramway undertaking, the loss on this service was due to the competition of motor-omnibuses. In Mandalay the greater part of the travelling population consisted of poor people to whom cheap fares were a necessity, and it would not be possible to run a regular service of motor-omnibuses in Mandalay at the low fares which were charged on the trams. It was estimated that the motor-omnibuses plying on the routes covered by the tramways were carrying approximately 50 per cent. of the traffic formerly carried by the trams. Regarding the future of the tramways, they were endeavouring to add to the comfort and convenience of passengers as they believed that this method of transport formed the only real solution of the problem of cheap transport. It was hoped that the authorities would eventually realise the

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disservice they might be rendering to the travelling public if the present conditions were allowed to continue. The report and accounts were adopted.

Low Temperature Carbonisation, Ltd.

The report for the 15 months ended October 31st, shows that sales and revenue totalled £115,069, and the trading profit amounts to £26,907. Maintenance, research, office and technical expenses absorb £19,990, interest on debenture stock requires £15,000, transfer charges, &c., account for £1,750, and debenture trustees' fees £197 resulting in a net loss of £4,494. The Barugh works has been in constant operation night and day during the whole of the 15 months, the second works at Askern is established, and a third works is being erected at East Greenwich for the South Metropolitan Gas Co. A crude coil oil distillery has been erected at Barugh. The demand for Coalite continues to increase at a greater rate than the supply.

Allen West & Co., Ltd.

The accounts for the year ended July 31st, 1929, show a net profit of £29,291; a balance of £54,175 brought forward is added, making £83,466. It is proposed to place £8,000 to depreciation reserve, to pay an ordinary dividend of 8 per cent., and to carry £61,612 forward. The expenses connected with the issue of 200,000 7 per cent. cumulative preference shares of £1 each in July last are to be written off out of capital reserve. The investment in subsidiary companies was increased during the year from £30,494 to £61,158.

Auto Electric Devices, Ltd.

The first report of the board, covering the period from July 14th, 1928, to September 30th last, says that difficulties with regard to machinery, &c., have arisen to delay the production of the company's self-winding gramophone motors. Inquiries which have been received indicate a good demand for the appliance. Steps have been taken to protect the device in a number of foreign countries. A net profit of £280 is reported.

Baird Television Companies.

It is reported that negotiations are proceeding between the Baird Television Development Co., Ltd., and the Baird International Television Co., Ltd., for an amalgamation of the two concerns. At yesterday's annual meeting, it was to be proposed that the meeting should be adjourned until early in the New Year.

Stock Exchange Notice.

Dealings in the following have been allowed by the Committee under Rule 159:—

Underground Electric Railway Company of London, Limited.—5,313 ordinary shares of £1 each fully paid, Nos. 7,278,273 to 7,283,585.

Manx Electric Railway Co.

The gross receipts for the year ended September 30th were £43,535, and the net receipts £11,893. After meeting debenture interest and sinking fund contribution, and paying a preference dividend of 2 per cent., less tax, for the half-year to September 30th, 1923, £3,492 is carried forward.

International Telephone and Telegraph Corporation.

It is announced that the total net income of the Corporation and its associated companies for the first nine months of the current year amounted to $13,613,805, equal to $2.33 per share. A quarterly dividend of 50 cents has been declared on the capital stock.

British Electric Transformer Co., Ltd.

The directors report that after deducting the balance brought forward from last year the accounts for the first half of the current year show a loss of £5,596. It is stated that in spite of unrestricted competition the factories are now working full time.

Anglo-Argentine Tramways Co., Ltd.

The dividends on the 5½ first preference and 6 per cent. second preference shares have been declared in respect of the half-year ending December 31st.

Lisbon Electric Tramways, Ltd.

An interim dividend of 3 per cent. has been declared, as last year.

Quebec Power Co.

A quarterly dividend of $⅝ has been declared on the common stock.

German Companies.

The *Electric Light & Power Investment Company*, of Berlin, recommends the payment of a dividend at the rate of 10 per cent. for 1928-29, as in the previous year.

The *Bank for Electrical Values*, of Berlin, which is an investment company associated with the A.E.G. group, reports a net profit of 2,643,000 marks for 1928-29, as against 2,247,000 marks in the previous year. The dividend remains at 10 per cent.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange markets have started to deal for the first account in the New Year, and the fact that people will not be required to put down any money until January 9th for what they buy now is a factor which makes for greater willingness to invest money that accumulates at this season of the year. So far as speculation is concerned, the spirit of enterprise is still checked by the uncertainties that prevail in regard to the Hatry settlement. On the other hand, the slump in America is definitely over, and revival of confidence, as well as of prices, rolls away one of the principal clouds that had been overhanging Internationals. The American recovery from the effects of the October-November collapses has been a great deal quicker than that on this side. This may be due to the fact that in the United States the slump, which had such serious consequences, brought the American Government into the field. On this side of the Atlantic, the present Administration has failed to provide any practical scheme for unemployment, and to stimulate languid trade.

County of London Electric.

A feature in the market for electricity supply shares is a sharp drop in the price of County of London ordinary, the quotation giving way from 47s. to 41s. 6d., from which it recovered a trifle to 42s. ex rights. The fall is due to the company's offer of ordinary shares at 36s. Holders of old shares were allotted one new in respect of three old. This provided a bonus valued at about 1s. per old share. The board is being criticised for not having taken advantage of the financial conditions that prevailed earlier in the present year, what time the prospect of a bonus would have had a favourable effect upon the price of the shares, whereas to make a new issue under present conditions was to invite the shrinkage in the old shares that has already occurred. County of London ordinary stood at one time this year at 57s. The criticism seems a little unjust, ignoring, as it does, the services that the County directors have rendered to their shareholders.

The price of the new shares, issued at 36s., started at 2s. 6d. premium, but within an hour or so it had advanced to 4s. premium. The difference between the prices of old and new shares is explained by the fact that the latter will receive no dividend until 1931. If the dividend for 1930 is maintained at 10 per cent., this will be equivalent to about 1s. 8d., taking tax at 4s. in the £. There is a good market in the new shares, which are changing hands with considerable freedom.

Electricity Supply Shares.

Other movements in the market for Home Electricity Supply shares have been mostly downward, though the falls are few and insignificant. Bournemouth & Poole gave way to 57s. 6d., partly in sympathy with the heaviness in County of London shares. London Electrics are a little lower at 26s. 6d., Midland Counties eased off to 27s. 6d. Egham & Staines are 1s. down at 33s., the new at 32s. Northamptons lost 6d. at 44s. Isle of Thanet ordinary retain their rise at the latter price. Scottish Power new shares remain at 27s. 6d., and the new Metropolitan Electrics at 5s. premium are a few pence lower than they were a week ago, Midland Counties new also being a trifle down at 1s. premium. Atlas shares are steady at 27s. 6d.; the preference hardened to 23s. 7½d. London Power debenture stock is up a point at 98.

Tax-free Investments.

There are people who like to receive their dividends in what is called tax-free form: that is to say, the company pays the income-tax and makes out the cheques for a net amount. A number of such shares are included in the electrical lists, and in our own catalogues are indicated by an asterisk, amongst these being, for instance, Babcock & Wilcox, Globe Telegraph and Trust ordinary, and Indo-European. Besides these, Adelaide Electric Supply "A" preference shares receive their 5 per cent. dividends free of tax. The price of the shares is 20s. 6d., dividends are due in March and September, and the yield is a shade under 5 per cent. net. Calcutta Electric 5 per cent. preference, with the same dividend dates, stand at 1 1/16, and pay 4¾ per cent. on the money. Lancashire Electric 6 per cent. preference, with June and December dividends, at 27s., pay 4⅝ per cent., and Oriental Telephones, on the basis of the last 12 per cent. dividend, at 2 15/16, return 4¼ per cent. on the money. Melbourne Electric Supply ordinary stock, at 173, and in receipt of 10 per cent. dividends, due June and December, pays 5¾ per cent. All these examples receive their dividends tax free. A number of the companies which in pre-war days used to declare their dividends free of tax, have changed over to the less-tax system. It is comparatively rare to find a company, accustomed to deduct tax from dividend payments, altering this system.

Shares on Offer.

Amongst the debenture stocks and bonds on offer may be mentioned a moderate amount of Associated Electrical Industries 4 per cent. mortgage debenture stock at 75, which gives a yield of £5 6s. 6d. per cent.; the interest service on these is very amply covered. The stock is redeemable at any time at 110. The present price carries the half-yearly interest

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due on January 1st next. A small amount of Newcastle-on-Tyne Electric 4½ per cent. consolidated first mortgage debenture stock can be bought at 94, this giving the modest return of 4¾ per cent. outright, but 5¼ per cent, taking into account redemption at 100 in 1939. The Company has the right to repay the stock earlier at 105. The interest service is covered more than eight times over by the amount available on last year's profits. Here, also, the price carries a half-yearly interest payment due on January 1st. There is a fair amount of stock on offer in Quebec Power 5 per cent. first mortgage sinking fund registered debenture at 97, which gives a yield of £5 3s. per cent. on the money, and the interest on which is well covered by the last year's profit figures. Atlas Electric & General Trust 5 per cent. debenture can be bought at 95, to pay £5 5s. 3d. per cent. The amount required for annual interest is £30,000, and on last year's figures there was £499,000 profit available to meet it. Perak River Hydro-Electric Power 7 per cent. participating debenture stock can be bought at 105, with February and August interest payments, this yielding £6 13s. 3d. per cent. The interest is payable out of capital during construction. The stock is entitled to a further participation of 2 per cent. non-cumulative dividend, ranking after the preference dividend. The £1 ordinary shares of the Company stand at about 10s., and there is a 5 per cent. guaranteed debenture stock, issued under the Trades Facilities Acts, which stands at 98, the latter carrying an interest payment due on February 1st next.

Telegraphs and Telephones.

After falling back to the neighbourhood of 36, Cables and Wireless "B" ordinary stock recovered to 37½, the "A" ordinary and the 5½ per cent. preference remaining unchanged at 76½ and 96, respectively. Speculative buying is responsible for the strength of the "B" stock, added to which it is said that a certain amount of bear-covering occurred on the part of those who had sold short of the stock during the flatness in Americans. Great Northern Telegraphs are better at 30, and further improvement occurred in Anglo-American preferred stock, the price advancing to 101½ on the fall in the Bank Rate, which had the effect of directing attention to well-secured investment stocks. Marconi Marines hold their substantial gain at 2 7/16. It is announced from Washington that the International Telephone & Telegraph Corporation will pay 400,000 shares to the Radio Corporation for the combination of the business. Apparently legislation will be necessary to permit the merger of the companies. International Telephones are quoted lower at 80, and American Telephone and Telegraph at 230.

Dollar Stocks.

Hydro-Electrics have been a very lively market, falling at one time to 37, as against 42 a week ago, and recovering to the latter price, the quotations being jerked up and down according to New York advices, speculation on this side following the shares, but only to a mild extent. Brazilian Tractions fell 7 to 39, then recovered to 41½. The preference shares are 10 points lower at 140. Montreal Light & Power shares, at 134½, have shed 2. Pennsylvania Power improved to 77. Shawinigan remains about 82½. In the Mexican group, Mexican Light & Power common shares, at 80, are five points higher. Mexican Tramways common are better at 30, and the 5 per cent. bonds at 74. Toronto 4½ per cent. guaranteed debenture is a little better at 94½. Power Corporation of Canada, at 81½, are better on the forthcoming developments in the Dominion. In the foreign division, Tokyo Electric 6 per cents. are dull at 92 ex dividend.

Home Railway Stocks.

The uncertainty that continues to attach to the Government's intentions in regard to the London traffic problem has resulted in a decline of business in the income bonds of the Underground Electric Railways of London. No alteration has occurred in any of the Tube issues. Districts look the cheapest of the group, though it is taken for granted that the Metropolitan will put up its dividend to 4 per cent. in the forthcoming announcement, and this rate, at 62½, would give £6 8s. per cent. on the money. The public require a lot of persuasion nowadays to induce them to take any particular interest in Home Railway stocks, which perhaps is not particularly surprising, in view of the disappointments of the past, and the continued pressure of road competition. London United Tramways preference shares have been changing hands around 4s. 9d. The last business done in the company's 4 per cent. first debenture stock was at 50 some weeks ago. London & Suburban Traction ordinary shares are quoted at 2s. 9d., the preference, as our lists show, being 10s. middle.

Miscellaneous Matters.

Amongst manufacturing shares the price of Callender's has gone back 2s. 6d. to 3⅜. Henley's are 1/16 better at 5 15/16. English Electric ordinary weakened to 5s., showing a fall of 1s. 3d. per share. Business in this section is subdued. Amongst iron, steel and allied shares, Babcock & Wilcox receded to 61s. 3d., and Vickers are dull at 7s. 9d. It is said, however, that Vickers are doing well at the present time, and that anticipation is likely to suffer no disappointment in looking for a repetition of at least the 8 per cent. dividend paid on these shares (of the nominal value of 6s. 8d.) last April. The rubber market remains extremely quiet.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom.	Approx. Dividend. 1927.	1928.	Price Dec. 16 1929.	Rise or fall	Yield p.c.
	£					
Bournemouth and Poole	1	15	15	57/6	—1⅜	5 4 4
Brompton Ordinary	1	8½	8½	25/6	—	5 9 10
Charing Cross Ordinary ...	1	8½	8½	26/6	—	5 5 8
do. do. 4½% Pref. ...	1	4½	4½	17/-	—	5 6 0
Chelsea	1	8¾	8¾	25/-	—	5 12 0
City of London	1	10	10	32/-	—	4 7 6
do. do. 6% Pref....	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	1½	—	... ...
County of London	1	7	10	42/-xR	—4/-	4 11 0
do. do. 6% Pref....	1	6	6	22/6	—	5 6 8
Edmundson's 7% Pref. ...	1	7	7	24/-	—	5 16 8
Elec. Supply Corporation ...	1	11	11	48/3	—	4 11 3
Kensington Ordinary ...	1	8	8	26/-	—	5 7 8
Lancs. Light and Power ...	1	7½	7½	27/-	—	5 11 2
London Electric	1	8½	9	26/6	—6d.	5 5 8
Metropolitan	1	9	9	37/6	—	4 16 0
do. 4½% Pref. ...	1	4½	4½	17/-	—	5 6 0
Midland Counties	1	6½	6½	27/6	—6d.	4 14 6
Mid. Elec. Power	1	15	8	33/9	—	4 14 10
Newcastle-on-Tyne Ordinary	1	6	6	23/9	—	5 1 1
do. 7% Pref. ...	1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref. ...	10	6	6	11	—	5 9 1
North Met. Elec. 6% Pref. ...	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall ...	1	8	8	26/-	—	5 7 8
Scottish Power	1	8	8	29/-	—	5 12 8
South London	1	8½	8½	25/6	—	5 9 10
Urban Ordinary	1	7	7	35/-	—	4 0 0
Westminster Ordinary	1	8½	8½	25/-	—	5 12 0
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	23/6	—	6 7 8
Yorkshire Elec.	1	8	8	33/9	—	4 14 10

HOME RAILS.

Central London Ord. Assented ...	Stock	4	4	71	—	5 12 8
Metropolitan	,	8	8½	62½	—	5 12 0
do. District	,,	4	5	72	—	6 19 0
Underground Electric	£1	5	7	21/6	—	6 10 3
do. do. Income ...	Bonds	6	6	103	—	5 16 6

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	101½	+1	5 18 3
do. Def.	,,	1½	1½	24¾	—	6 4 5
Automatic Telephone ...	1	10	12½	37/6	—	6 18 4
Cables & Wireless 5½ Pref.	Stock	—	—	96	—	5 14 7
do. A 7½ Ord.	,,	—	—	76½	—	... ...
do. B Ord.	,,	—	—	37½	—	... ...
Globe Tel. and T. Ord. ...	10	10	10	23	—	*4 7 0
do. do. Pref.	10	6	6	10⅞	—	5 9 1
Great Northern Tel.	10	20	17½	30	+1	5 16 8
Indo-European	25	10	10	52½	—	*8 16 2
Marconi-Marine	1	12½	15	2 7/16	—	... ...
Oriental Telephone Ord	1	12	12	2 1/16	—	*4 5 5

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	8⅛	—	8 16 0
do. do. 2nd Pref. ...	5	6	6	3⅜	—	9 12 0
do. do. 5% Deb. ...	Stock	5	5	72½	—	6 18 0
British Electric Traction Def. Ord.	,,	5	5	1525	—	... ...
do. do. Pref. Ord.	,,	8	8	120	—	6 13 4
Brazil Traction	100	7	8	41½	—4½	4 16 5
Brit. Columbia Elec. Rly. Pcc. ...	Stock	5	5	87½	—	5 14 3
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	10/-	—	... ...
London United Tram Deb. ...	Stock	4	4	51½	—	7 15 4
Mexico Trams, 5% Bonds	—	5	5	74½	+1½	6 15 2
Mexican Light Common	100	Nil	Nil	75	—	... ...
do. 7% Pref.	100	7	7	77½	—	9 0 3
do. 1st Bonds	—	5	5	73½	—	6 16 1
Victoria Falls Ord.	1	15	15	2⅞	—	5 4 2
Yorkshire (West Riding)		Nil	Nil	5/-	—	... ...

MANUFACTURING COMPANIES.

Assoc. Elec. Ord.	1	6	—	25/9	—	4 13 2
Babcock & Wilcox	1	18	15	61/3	—9d.	*4 16 0
British Aluminium Ord.	1	10	10	46/-	—	*4 7 0
British Elec. Transformer Pref. ...	1	7	7	18/-	—	... ...
British Insulated Ord.	1	15	15	8⅝	—⅛	4 2 8
Brush Ord.	Stock	10	10	126½	—	7 18 1
Callenders	1	15	15	8¾	—	4 0 0
do. 6½% Pref.	1	6½	6½	1½	—	5 4 0
Crompton Parkinson Ord.	5/-	—	80	20/-	—	7 10 0
do. 8% Pref.	1	8	8	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	7 1 2
do. 5% Deb.	Stock	5	5	84½	—	5 18 4
Electric Construction	1	7½	5½	15/-	—	7 6 8
Enfield Cable Ord.	1	20	20	4⅝	—	4 2 0
English Electric	1	Nil	Nil	5/-	—⅛	... ...
do. do. Pref. ...	1	8	Nil	7/6	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
do. Ord.	1	10	10	2⅜	—	4 4 3
Henley	1	25	30	5 13/16	+1/16	5 1 0
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	Nil	Nil	11/3	—	... ...
Johnson & Phillips	1	10	—	36/3	—	5 10 3
Siemens Ord.	1	7½	7½	26/3	—	5 14 3
Telegraph Construction	12	10	10	23	—	*5 4 2

*Dividends paid free of Income Tax.

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Brazil's Electrical Imports.

Share of Leading Countries.

THE Brazilian Government, possibly owing to the visit of the d'Abernon Mission, has published statistics for 1928, compared with previous years, of the foreign trade of Brazil in certain leading items among imports and exports. The electrical business is dealt with in considerably greater detail than has been the case for some years, and we are able to give below tabular statements showing the weight and value of imports in 1927 and 1928, based on the classification of the Brazilian Customs, distinguishing the chief countries of origin of the leading lines of electrical goods :—

BRAZILIAN IMPORTS OF MACHINERY FOR ELECTRICITY AND ELECTRIC LIGHT.

	1927		1928	
	Tons.	£ (Thous.)	Tons.	£ (Thous.)
Total ...	5,217	1,063	6,129	1,247
From Great Britain ...	759	173	782	171
,, United States ...	2,162	531	2,915	637
,, Germany ...	1,183	177	1,601	250
,, Italy	501	70	238	40
,, France	161	139	153	37
,, Belgium ...	179	16	126	16

It will be seen that Great Britain's share of the total value of imports was, in 1927, 16 per cent., and in 1928 nearly 14 per cent., while that of the United States was 50 per cent. and 51 per cent., respectively, and of Germany 16.5 per cent. and 20 per cent., respectively.

ELECTRIC DYNAMOS AND GENERATORS.

	1927		1928	
	Tons.	£ (Thous.)	Tons.	£ (Thous.)
Total ...	1,345	194	1,065	172
From Great Britain...	70	15	130	32
,, Germany ...	373	44	505	61
,, United States ...	610	97	237	57
,, Switzerland ...	186	25	107	12

It is noteworthy that Germany's share in the total value of the trade last year was the largest, *viz.*, 35 per cent., as compared with only 22 per cent. in 1927, thus taking the place occupied in 1927 by the United States, which then accounted for 50 per cent. of the trade. Great Britain's proportion was 18 per cent. in 1928, and only 7.5 per cent. in 1927.

ELECTRIC MOTORS.

	Tons.	£ (Thous.)	Tons.	£ (Thous.)
Total ...	1,605	244	1,690	251
From Great Britain...	205	35	212	37
,, United States ...	494	93	475	88
,, Germany ...	379	50	440	59
,, Belgium ...	78	8	185	17
,, Sweden ...	107	12	112	13
,, Italy	121	14	104	13

The United States has the largest share in this business, probably due mainly to the supply of traction motors to Rio de Janeiro, its proportion of the total value being 38 per cent. in 1927 and 35 per cent. in 1928, while Great Britain's share remained at about 14 per cent. Germany was an important supplier, securing nearly a quarter of the total trade.

ELECTRIC TRANSFORMERS.

	1927		1928	
	Tons.	£ (Thous.)	Tons.	£ (Thous.)
Total ...	1,526	202	1,717	207
From Great Britain...	261	36	173	17
,, United States ...	759	107	948	128
,, Germany ...	265	28	361	38
,, Sweden	17	2	64	6

Great Britain's participation in this trade compares unfavourably with that of either the United States or Germany, the percentages in 1927 and 1928 of these three countries, respectively, being :—18 and 8; 53 and 62; and 13.5 and 18.5.

ELECTRIC CABLES.

	1927		1928	
	Tons.	£ (Thous.)	Tons.	£ (Thous.)
Total ...	2,937	202	2,802	182
From Great Britain...	928	54	1,299	70
,, United States ...	532	55	359	35
,, Belgium ...	193	15	231	18
,, Germany ...	528	28	289	18
,, Italy	520	29	226	11

There was also, in 1928, an import of these goods from Canada of 317 tons, value £28,000. While Great Britain's share in the value of this trade rose from 27.5 per cent. in 1927 to nearly 40 per cent. in 1928, that of the United States fell from 28.5 per cent. to 19.5 per cent., and that of Belgium rose from 7 per cent. to 10 per cent, while the shares of Germany and Italy decreased.

Batteries on Board Ship.

Points of Interest in Connection with a New Development in the use of " Exide Ironclad " Accumulators.

By A. C. Hardy, B.Sc., A.M.Inst.N.A.

ONE of the most striking phases in marine engineering technique during the past ten years has been the ever-increasing use to which electricity is being put on shipboard, and in particular the use which is now being found for electric accumulators.

Batteries, of course, and in particular the type which is made by the Chloride Electrical Storage Co., Ltd., of Clifton Junction, Manchester, are not strangers to sea use, because for many years " Exide Ironclad " batteries have been fitted to British submarines of all sizes for propulsion under water.

Storage batteries, apart from their use in submarines, until comparatively recently have been largely connected with such relatively auxiliary matters as wireless telegraphy, and the supplying of light to certain limited portions of the decks in passenger ships in the event of the main power source failing.

To-day, however, there are available batteries which can take over the whole of the steering of the ship, should the main power plant give out, supply power for handling the boats, and, in conjunction with the deck auxiliary generating set, can act as an auxiliary engine room on deck, whereby winches, windlass, deck lights, navigation lights, boat-lowering gear, and steering gear can be operated if the main engine room is entirely flooded.

There is, too, another function of the battery which has only recently begun to attract the attention of owners of coastwise shipping. This may perhaps be best illustrated by taking a particular case of a ship carrying steel plates on the Great Lakes of North America. This ship is not large, but is of a type usually known in Europe as a coaster. Her cargo capacity is just over 2,000 tons, and she has a total of 750 h.p. for propelling her at about 9 knots. The whole of the auxiliary installation of the ship is electrically driven, there being for this purpose two 90-h.p. airless injection Diesel engines, each coupled to a 60-kW 240-volt compound-wound generator. For cargo handling there are two 5-ton cranes, each driven by a 65-h.p. electric motor. As originally completed the ship had no battery installation, and it was found that when both cranes were working at once a considerable overload resulted, particularly as the stevedores showed a tendency to run the hoists on one or two points of the starting handles. This peak load caused the running of the auxiliary generator sets to be far from satisfactory.

Two banks of " Exide Ironclad " cells have now been installed in this ship, with the result that during unloading operations at the present time one generator set can be cut out completely, with a corresponding saving in fuel.

During peak loads the batteries feed into the line, preventing the over loading of the generator, and when any particular load has been hoisted the generators charge the batteries. The generator engine thus operates at a constant speed without over-loading.

The manufacturers of " Exide " batteries contend that what is possible with a ship of this type under such severe conditions of unloading, should be very definitely possible on smaller types of cargo vessels, and to-day they have come into the market with a range of batteries suitable for practically every type of marine work.

The Chloride Company has been connected with marine battery manufacture for some 30 years, and has made a special study of the problems relating to their application on board ship. The " Exide Ironclad " battery is specially designed to operate successfully under conditions involving heavy electrical discharges, mechanical vibration, and swirling of the electrolyte. The principle upon which the cells are built up precludes any growth of buckling of the plates, assures low internal resistance, and permits of very high discharge currents without undue drop in voltage.

The active material of the positive plate is enclosed in slotted ebonite tubes, and is thus held securely in contact with the grid which conducts the current to the terminals. The slotting of the ebonite is of a fine nature, and in consequence the electrolyte is allowed free diffusion to the active material, whereas the latter cannot fall away from the tube. The negative plate consists of a hard alloy grid with a lattice structure, forming a flat cage which holds the active material in the form of continuous strips. This method of construction results in low internal resistance, and renders the plate unaffected by vibration or other mechanical stresses. Special durable wood separators are arranged between the plates in cells, and these are subjected to a process which eliminates elements injurious to the batteries.

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A Large Supply Control System.

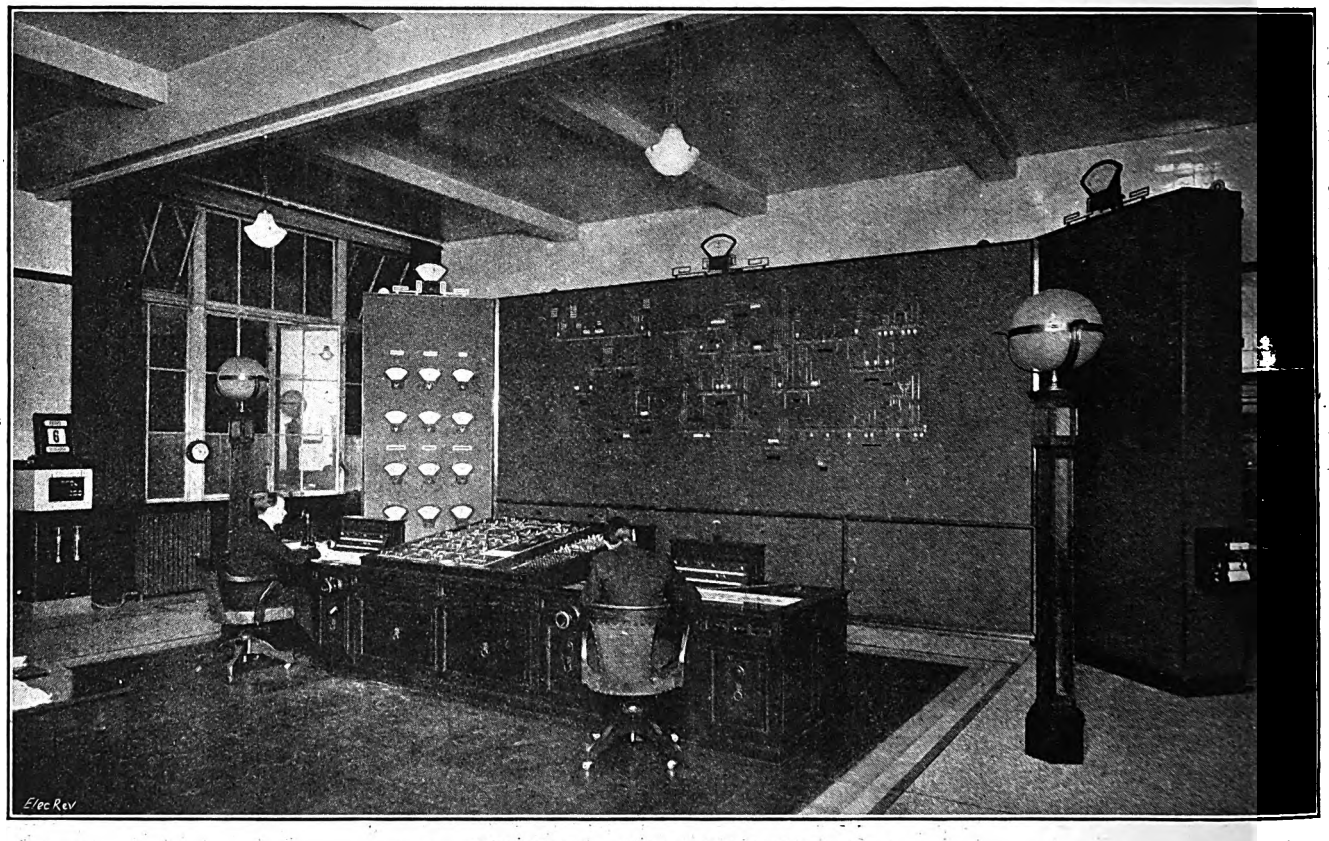
Notes on the Control Centre at Ergon House of the London Power Co., Ltd.

THE control of a system such as that of the London Power Co., Ltd., necessarily involves for its effective operation the collection of a considerable amount of data with regard to the frequent changes in the climatic conditions, as the area supplied is very sensitive to the intensity of the light or the degree of visibility and to the atmospheric temperature.

By observing the daily actual load demand at or about 8 a.m., and after studying the weather conditions, the control engineer, by means of the use of functional constants or by reference to specially prepared curves, is able to establish an estimate of the morning peak load. With this estimate in front of him he allocates the anticipated total load to the various generating stations, and therefore at or about the hour named each station is informed as to what proportion it will be expected to meet at the morning peak, is instructed as to what plant to have on line, and also as to the amount of power to be held in reserve. The same procedure takes place at or about 2 p.m. in connection with the evening peak load.

room is the control desk, which may be conveniently divided into three sections—left, centre and right. The centre portion is designated the control switchboard, and is flanked on either side by control desks equipped with telephones by means of which any point of the system can be communicated with. Immediately facing the control desk at a distance of some 13 ft. is a steel structure, also conveniently divided into three sections. The left wing or instrument panel is equipped with instruments for indicating the following particulars from each generating station: operating steam pressure of the boilers; total instantaneous output of the station; voltage obtaining at the station; and the frequency of the supply from the generators.

This information is transmitted automatically from each generating station to the instruments on the aforesaid instrument panel in the control room by means of pilot wires laid between the generating stations and Ergon House, so that the indications on the master instruments in the generating stations are faithfully reproduced on the instru-



The Ergon House Control Room.

In order to ensure conditions of greatest possible safety, not only to individuals, but also to the system generally, no switching operations are allowed without the consent of the control engineer nor can work be undertaken or commenced on any e.h.p. apparatus until he has sanctioned the issue of a "permit-to-work" card. Very exacting general regulations have been issued, covering the operations and maintenance of e.h.p. cables, switchgear, and all other equipment, and special instructions have been issued to cover conditions arising when a state of emergency exists, so that the control engineers may be confident that their instructions will receive immediate attention.

The control of the 22,000-volt interconnected system of the London Power Co. is directed from Ergon House, where one or more control engineers are always on duty. The control room is approximately 35 ft. square, is well provided with natural light, and occupies a position in the building which renders it quiet and free from noises likely to distract the attention of its occupants. The control of the whole of the system of the Power Company is effected largely through the medium of a suitably planned and efficient system of telephonic communication between the control centre, generating stations, switching stations and all the principal sub-stations connected to the system. Approximately in the centre of the

ments in the control room Immediately at the top of this wing is a voltmeter, indicating the voltage of the interconnected system. By means of a multiway switch the voltage obtaining at any one of the generating stations can be indicated on this instrument. At the bottom of the panel is the frequency indicator of the system.

The centre or system-diagram panel is composed of ¼-in. thick steel plate specially treated with a cellulose paint of such a shade as to be restful to the eyes. All the feeders and interconnecting cables between the generating stations, switching stations and distributing stations are depicted by monel metal strips. This diagram indicates to the control engineers in what manner the system is electrically coupled, and the "in" or "out" position of every switch on the system. The switches at every generating station, switching station and distributing station are represented on the diagram by small "light windows," and by means of a special system of lighting a green light or red light appears in the window, depending upon whether the switch at that point is switched "out" or "in." No light appearing in the window indicates that the particular switch is out of commission and is isolated.

The illumination of the "light windows" representing switches on the system is controlled from the centre portion

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of the control desk by means of miniature switches which are operated by the control engineers.

The control engineer, by means of the telephone, communicates with a responsible person at the point at which he requires an alteration to the switching conditions made. On the completion of the operation he then "dresses the board," *i.e.*, by means of the miniature switches on the control switchboard, he repeates the operation he directed to be carried cut, thus reproducing on the "mimic" diagram the altered conditions of the switching at the point in question. Every "light window" representing a switch on the mimic diagram has a corresponding miniature switch on the control switchboard, each switch being provided with a coloured handle conforming to a colour scheme which has been introduced in order to facilitate the dressing of the system diagram, so that in effect the control switchboard is a check upon the diagram.

A "plant panel" at the bottom of the diagram panel is provided with a "light window" for every boiler and generator installed at each of the generating stations. The illumination of these "light windows" is also controlled by the control engineers, and is based on information obtained from time to time from the several generating stations. They are thus enabled at any time to observe at a glance the following particulars obtaining at each generating station: boilers steaming; boilers in reserve; boilers out of commission; generators on line; generators in reserve; and generators out of commission.

Every boiler and generator is numbered and has its own corresponding "light window." A red light in the window indicates that the boiler or generator, as the case may be, is, in the case of a boiler, steaming; or, in the case of a generator. on line. A green light in the "light window" indicates that the boiler or generator is held in reserve, while non-illumination indicates that the plant is out of commission.

Immediately above the centre panel is placed a kilowatt indicator, and it is on this instrument that the total instantaneous load on the whole 50-cycle system of the company is indicated, the readings of the individual station output instruments being summated. In the centre of the lower panel below the system diagram there is inserted a cyclometer upon which is indicated the total output capacity of the generators connected to the system, so that by deducting therefrom the reading of the kilowatt indicator the amount of reserve output is immediately obtained.

The right wing is at present unequipped, but is held in reserve for the accommodatoin of any instruments which may be necessary for indicating the load and other electrical conditions obtaining at the several points of connection between the Power Company's system and the grid or other lines of the Central Electricity Board.

On the right hand wall of the control room there is a case containing a swinging pendulum and three dials. This piece of apparatus constitutes the device for maintaining standard "frequency" over the whole system. The frequency control system was described in our issue of November 22nd, 1929, p. 1920.

In designing the present "control," emphasis has been laid on the desirability of maintaining personal contact between the control engineers and the personnel at the various power houses, switching stations and sub-stations, with the resulting establishment of a desirable team-work spirit. For this reason the employment of automatic indications has been kept down to a reasonable minimum, consistent with the foregoing requirements and the avoidance of the use of complicated transmitting and recording instruments.

The B.I.C. Wire Mills.

A Note on some of the Plant Recently Installed.

THE policy of Messrs. British Insulated Cables, Ltd., is, we are informed, to introduce up-to-date machines in every process, from the casting of the wire-bars to the drawing of the finest wire, as soon as occasion demands. Thus, the new refinery, where copper scrap is turned back into the required form of ingots, is equipped with three oil-fired melting furnaces, and air heaters of the latest pattern are being fitted, thereby capturing much of the waste heat and returning it to the furnaces. The latest labour-saving type of horizontal baling press, with a receiving box at floor level, which self-ejects an almost solid bale, is now being erected. In addition, an ingenious form of electrical reversing planing machine, with double table, has recently been installed for trimming the copper ingots.

The new rolling mill, which rolls the copper bars down to ½-in. diameter rod for drawing into wire, is driven by a 1,226-h.p. motor. The wire-bars are loaded in the warehouse on to roller-bearing trucks, which carry them to the back of the reheating furnaces, where an electric elevator brings them into position for the electrical pusher to push them through the furnaces. The heated bars fall on a live roller table at the other end of the furnace, where they are self-conveyed through the first pass of the roughing mill. After this a certain amount of hand-tonging is necessary, but as the rod passes through the intermediate and finishing rolls automatic repeaters come into action, and the ½-in. rod finally passes through pipe guides to the winders, where it is coiled up and dropped on to a conveyor for transfer to the pickling plant. During the annual shut-down for repairs this year, several structural alterations were made in order to deal with copper bars 78 per cent. heavier than was those at present rolled.

The pickling plant has recently been re-designed to speed up and improve the operation. The pickling acid is circulated through an electrolytic depositing plant (recently reconstructed) which extracts the copper from the solution in a convenient form for melting, and re-conditions the acid. The pickled rod is at present conveyed to the wire-drawing machines on electric trucks, but a semi-automatic conveyor system is shortly to be introduced.

In the wire-drawing shop the new machines are fed continuously, one rod being electrically welded on to the next before passing through the machine. This shop also contains the new machines for drawing aluminium wire specially for the British grid scheme. The general principle of construction is the same as that of the copper machines, but in detail the drawing of aluminium presents many difficulties, which can only be overcome by the introduction of special "gadgets."

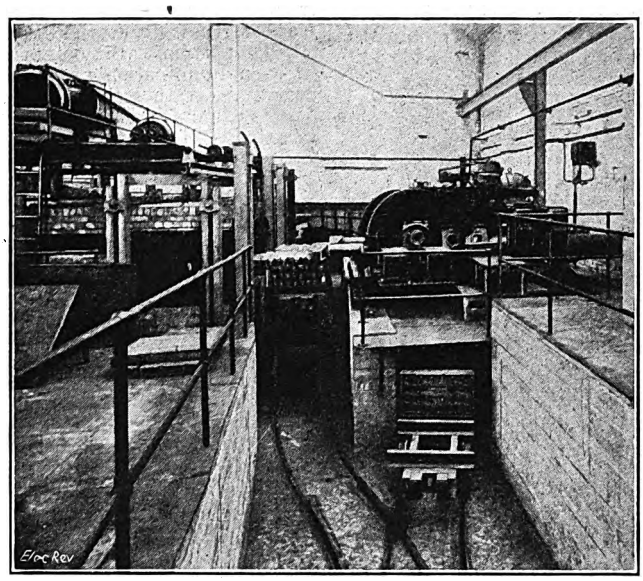

Fig. 1.—Charging Plant for Re-heating Furnace.

It has been necessary to extend the sheet mill to nearly double its original size. The high standard of finish obtained can be best described by stating that copper sheets for photo-engraving purposes are produced, and aluminium sheets are supplied to motor manufacturers of high repute, machine-cut gears being used for driving the rolls. Amongst recent additions to the plant are guillotine shears to cut 10 ft. at one stroke, and a blanking press to cut circles up to 16 in. in diameter.

Transport between the various sections, and also in the packing and export section, is carried out almost entirely by electric battery trucks. Over 20,000 tons of copper is dispatched annually, in addition to aluminium and various alloys.

A new departure is the drawing of "Copperweld" wire, a bi-metal, consisting of a steel core completely covered with copper, for use where strength and non-rusting properties are most important.

Although the test room is already provided with every instrument required for accurate mechanical and electrical tests, orders have been placed for further machinery of special construction, whereby the human element is eliminated as far as possible. These machines are particularly adapted for the weaker materials, such as aluminium and very fine copper wires, with which a slight error of movement on the part of the tester would have an appreciable effect on the tests carried out. New technical offices have also been built.

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New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

A New Gate-end Loader.

The new troughed-belt coal loader, fig. 1, being introduced by Messrs. MAVOR & COULSON, LTD., 47, Broad Street, Mile End, Glasgow, S.E., embodies some new and interesting features. Lightness and portability are combined with a rigid and stable structure, thus overcoming difficulties experienced with many gate-end loaders. Inverted steel troughing forms a continuous platform for support of the troughing idlers and a housing for the return belt and its idlers. The inverted troughing extends the whole length of the loader, forming a light but rigid structure to carry the idlers for the top and bottom sides of the belt. By this structure the troughing idlers can be adjusted to ensure true running of the belt, and the return side is completely protected against the possibility of any spillage falling on it; spillage of coal on the return belt, one of the chief causes of trouble with flat belt conveyors, is thus entirely prevented No side plates to keep coal from rolling off or guide pulleys to make the belt run straight are required. The troughed form of belt enables large lumps to be handled with security, and gives so great a capacity that the 26-in. belt can convey 125 tons per hour. The loader is light in weight and easily flitted back from the face to allow the rippers to work, the large diameter wheels running smoothly along the ordinary tub rails. The height of the receiving end above the floor is unusually low for a belt loader, an important feature in thin seams. The receiving end is joined to the structure by a hinge, and when flitting the end lifts; when the loader is again placed in position at the face the receiving end drops on to the floor, and is immediately ready for use without re-adjusting the belt tension. Rollers are provided to support the ends of the shaker conveyors, and apron plates feed the coal on to the belt. The tail pulley gear is completely encased, so that it cannot be jammed by small coal. Tension is applied at the slack side of the driving drum by screws, which are readily accessible and easily adjustable, although out of the way of injury. The belt has a large lap around the driving drum. The drum is driven by a bush roller chain, the sprockets providing means of altering the belt speed should the loader be required for greatly changed duty. The patent driving unit consists of worm reduction gearing, totally enclosed and running in oil; the worm is mounted on an extension of the motor shaft, and the motor or turbine is bolted direct to the structure of the gearcase, making a compact self-contained unit. The driving gear, being mounted centrally under the inclined portion of the structure, adds to

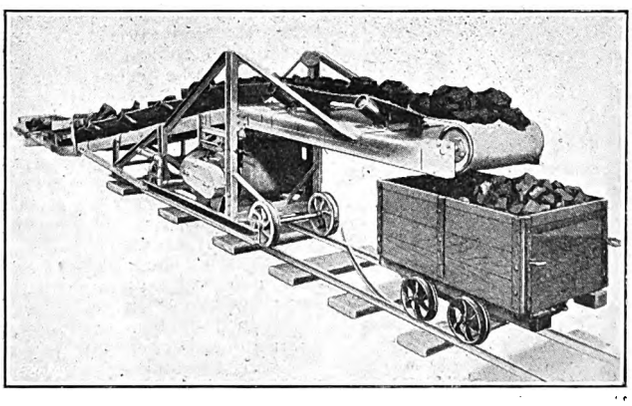

Fig. 1.—The M. & C. Troughed-Belt Loader.

the stability of the loader, and at the same time protects the gear from damage. The loader is controlled from the end of the jib, either by a rod which operates the electric starter or by a cock which regulates the air supply. Face conveyors may also be controlled by the man at the loading point. If electric, a three-panel switchboard may be mounted on the side of the loader, and operated by rods from the discharging end of the jib.

Hotel-fire Charge Collectors.

A development of the "Utility" hotel-fire charge collector recently introduced by ELECTRICAL UTILITIES, LTD., Tudor Works, Park Royal, N.W.10, and described in our issue of November 15th last, p. 874, provides for the automatic switching off of any number of collectors in a hotel by means of a master time switch. A solenoid on the trip coil of each collector is energised by the time switch at any pre-determined time, and by this means all the collectors are tripped simultaneously. It is suggested that about 4 a.m. would be a convenient time for the operation of the time switch, but in the case of illness a collector could easily be disconnected.

A Special Flood-lighting Appliance.

Among the new and interesting lines described in the catalogue No. 1,100 published by BENJAMIN ELECTRIC, LTD., Brantwood Works, Tariff Road, Tottenham, N.17, the

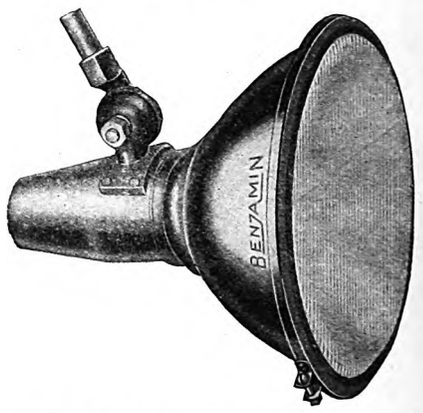

Fig. 2.—The "Projectolux" Flood-lighting Unit.

"Projectolux," fig. 2, is worthy of special mention. This is a specially designed lighting unit for use wherever light will strike the surface to be illuminated at an acute or grazing angle—the sort of lighting which is necessary when the light source cannot be mounted directly above horizontal surfaces or straight out from vertical surfaces. The powerful floodlight beam which is projected by the special internal chromium-plated reflector is flattened and broadened out by a special front lens which directs the greater part of the light to a point farthest from the light source and a correspondingly smaller portion to the points nearer the reflector. This results in even illumination over the entire vertical surface. Many uses suggest themselves for this particular reflector, and a simple example is the body construction or body painting shop in a motor-car factory, in which it is necessary to get a good intensity of illumination on the curve of the lower portion of the bodies. The unit is designed for use with a 300-watt lamp, is capable of being tilted or rotated at any angle, is vapour proof, and is wired with 6 ft. of special asbestos-covered wire ready for connecting by means of an ordinary plug-and-socket or plug-and-lampholder connection.

A Small Portable Printing Press.

The "SLOGANPRESS" COMPANY, 83, Farringdon Street, E.C.4, has brought to our notice a printing press which would appear to be a distinctly useful piece of apparatus in all businesses that advertise, particularly for such matters as overprinting agents' names and addresses, and printing slogans on letter paper or envelopes. Ordinary printers' type is used, and the overall dimensions of the machine are 8 in. by 5¼ in. by 7 in. To print, all that is necessary is to bring forward a handle.

A New Bell Push.

The "Tell-Tale" bell push recently introduced by the RUNBAKEN MAGNETO CO., Tipping Street, Ardwick, Manchester, incorporates a small electric lamp which glows when the bell circuit is completed, thus indicating that the bell at the other end of the line is operating, or at least that it is receiving the necessary operating current correctly.

An Electric Car-Radiator Heater.

The latest addition to the numerous heating devices intended to be used in private motor garages during the winter months in order to keep the temperature of the water in the radiators and engine jackets of cars above the freezing point, is the "Everwarm" which has just been put on the market by Messrs. WHITEHOUSE, WILLETTS & BENNION, LTD., Rex Works, Tything, Worcester. The new heater is of such a shape to entirely cover the front of the radiator, and is intended to be hung from the filler cap; it embodies two electric heating elements, one of which becomes "live" when the

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flexible lead is plugged in to a source of electricity supply, the second one being controlled by a separate switch directly mounted on the heater. The "Everwarm," fig. 3, is made in two sizes, one with two 300-watt elements for commercial vehicles and for cars over 16 h.p., and one with a pair of 125-watt elements for vehicles under 16 h.p. The makers claim that the heat of one element will prevent the radiator water from

Fig. 3.—The "Everwarm" Car Radiator Heater.

falling below a temperature of 30 deg. F., while on frosty nights when a lower temperature may be reached, the use of both elements is recommended.

New Bakelite Accessories.

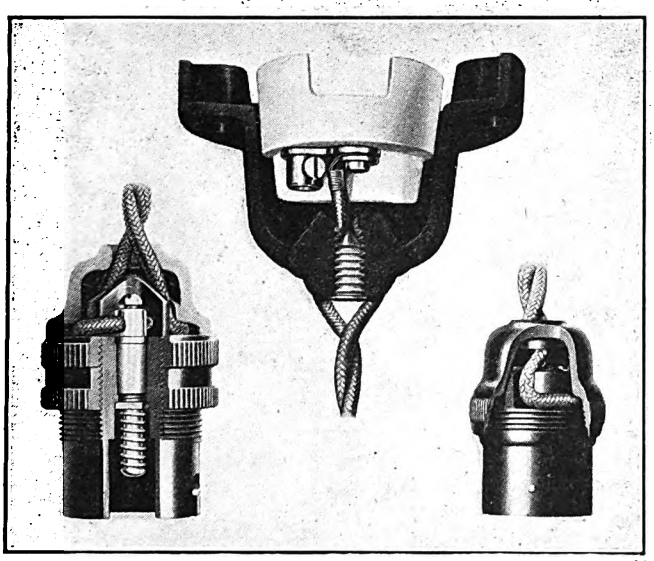
The accompanying illustrations, figs. 4 to 6, depict bakelite accessories recently introduced by METRO-VICK SUPPLIES, Trafford Park, Manchester.

The new M-V bakelite ceiling rose, fig. 5, is made in the popular size of 2½ in. diameter in both two- and three-way in either brown or cream. There are few parts, a fact which accounts for easy and quick wiring. The appliance is light, but mechanically strong, and breakages both in transit and use are, it is claimed, negligible.

The new M-V lampholder, fig. 4, is of universal application, as it will take, it is claimed, all flexibles. The mouldings are robust, and are made to fine limits to ensure interchangeability. "Emvee" plungers are employed, while, "Mycrome" alloy springs overcome the disadvantage of softening springs while under heat, as the following extract from a N.P.L. report attests:—

"Mycrome" springs, after being subject to a temperature of 200 C. for 48 hours, slightly increased in tension.

The Metro-Vick bakelite adaptor, fig. 6, is unique in having a cordgrip of universal application. It entirely eliminates



Figs. 4 to 6.—"Metro-Vick" Bakelite Accessories.

strain of the conductors on terminal screws, an essential feature for every specification where safety and security for the user is required. For a.c. currents it is claimed to be an indispensable unit.

The GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, has just added to its "Magnet" bakelite range of electric lighting appliances a detachable ceiling rose, fig. 7. This ceiling rose, which has a 2½-in. base diameter, with two fixing holes at 2-in. centres, is so designed as to be suitable for mounting directly to conduit boxes of B.S.S. The advantage of installing this plug-in or detachable-type ceiling rose should more than compensate for the slight extra initial cost, particularly in mills, factories and works where colour-washing or painting of ceilings and walls must be carried out at frequent periods to comply with appropriate regulations. With the ordinary type of fixed-pattern ceiling rose, pendants can only be removed by disconnecting at the ceiling point and rewiring for replacement. With this new ceiling rose it is only necessary to unscrew the clamping ring and withdraw the two-pin plug, replacement being carried out with equal facility. The disconnection of pendants during renovations enables shades or reflectors and lamps to be cleaned at the bench, and their removal during such periods prevents their being

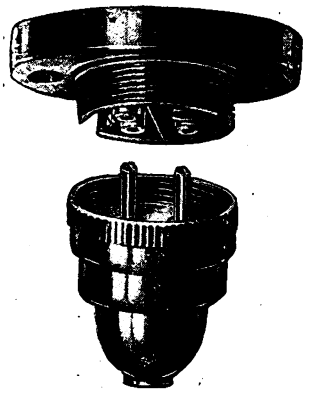


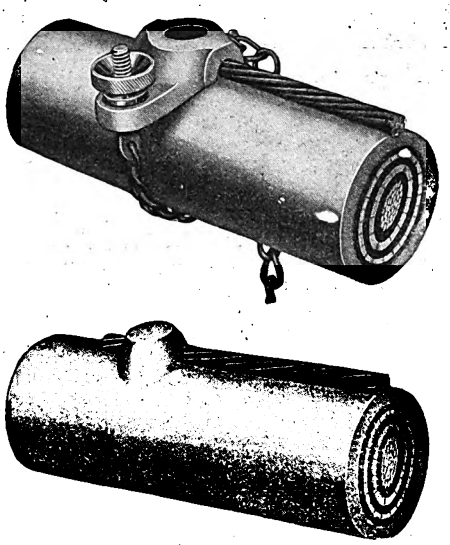
Fig. 7.—The "Magnet" Detachable Ceiling Rose.

smothered with whitewash, &c., with the saving of consequent labour in cleaning off afterwards. Also in the initial stage of installation the pendants can be wired up at the bench instead of at the ceiling point, a time-saving advantage which is obvious.

Coincident with this ceiling rose the G.E.C. has introduced a three-hook suspension plate for ceiling roses, for earthing metal parts of bowl pendants. This suspension plate has been designed for the purpose of connecting the metal work of any three-chain suspenson pendant bowl fitting directly to the conduit box, thus ensuring earth continuity. The plate is intended for fixing between the ceiling rose and conduit box. Any type of ceiling rose can be used in conjunction with the plate, but the facility with which a bowl fitting can be removed, together with the lamp pendant, when renovations are in progress, will, it is claimed, appeal particularly to installations and maintenance engineers when associated with the ceiling roses described above.

A Cable-bonding Mould.

Messrs. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Holborn Viaduct, E.C.1, have just introduced a handy little time



Figs. 8 and 9.—The "Henley" Bonding Mould in Position, and a Bonded Cable.

saver for making soldered bonds on the lead sheathing of cables. It requires no expert knowledge to use and produces, it is claimed, thoroughly effective bonds. This device, known as the "Henley" bonding mould, is shown in the accompanying illustrations, figs. 8 and 9, and the following brief instructions explain how it is used. Scrape a bright patch on the lead sheathing—fasten the mould and earthing strand in position, using the chain fastener, and tighten by means of the milled edge nut. Sprinkle a pinch of powdered resin on the strand and lead through the circular opening in top of the mould and then fill up with solder. To remove the mould after cooling, slack back the nut and unhook chain. Three sizes are made to suit the following cable diameters, measured over the lead sheathing:—

Above 0.945 up to 1.22 in., 24 to 31 mm.
Above 1.22 up to 2.008 in., 31 to 51 mm.
Above 2.008 up to 3.11 in., 51 to 79 mm.

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A Kinema Lighting Scheme.

Some Notes on the Installation at the new "Commodore" Theatre, Hammersmith.

WHAT is claimed to be one of the most notable lighting installations of recent years is that at the "Commodore," Hammersmith, for which the General Electric Co., Ltd., supplied the lamps and lighting appliances. The ivory terra-cotta front of the building is eminently suitable for flood-lighting purposes, since the absorption coefficient is low, and a large amount of reflected light is therefore assured at all times. The twin floodlights for the upward

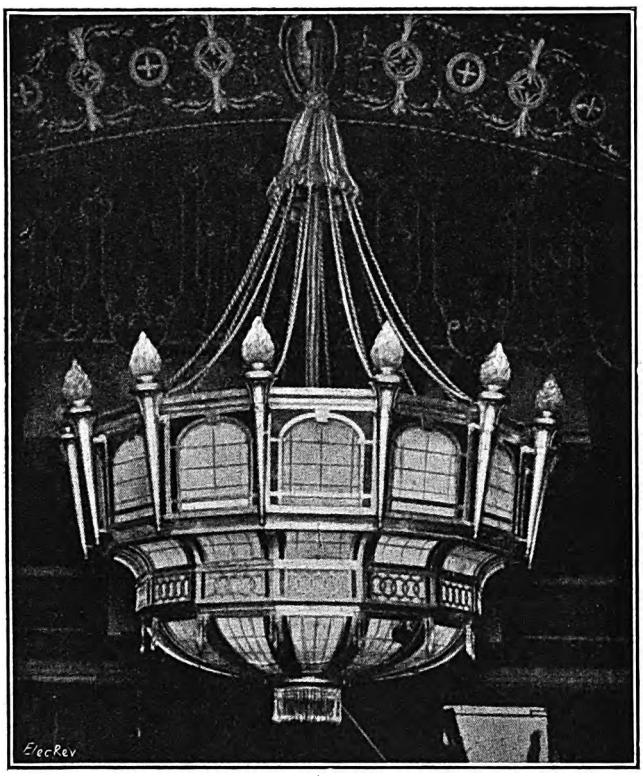

Fig. 1.—Auditorium Centre Unit; 12 ft. Diameter.

and downward lighting of the front of the building are of special design, fashioned on the "Tivoli" lines, and finished in gilt. The canopy is also illuminated in an attractive manner to give a flood of light to the main entrance. In addition to the twin floods, each equipped with 500-watt lamps for upward flooding and 200-watt lamps for downward lighting, there have been installed ten "Gecoray" silvered-glass flood projectors of an entirely new type. These are mounted over the canopy to illuminate the face of the building, and are equipped with 500-watt lamps.

Inside the theatre the main hall, or vestibule, is very well lighted by a number of specially-designed panelled-glass fittings, which incorporate some excellent examples of choice metal work, and are supported by means of silk cord suspensions. To the right and left of the entrance hall are small waiting rooms, illuminated by specially designed boat-shaped lighting units somewhat similar in design to those in the main hall.

In the auditorium, which is practically rectangular, with a gentle curve from the front of the stalls to the proscenium, the illumination is contrived by means of a central pendant 12 ft. in diameter, fig. 1, suspended from the auditorium roof, and a number of specially-designed under-gallery units of pleasing proportions. The large central unit is of special design. Over four thousand lamps, ranging from 10 to 1,500 watts each, are installed throughout the building. The large central fitting is glazed with a special form of diffusing glass made under an entirely new process. One very pleasing feature of this is the gilt edging of the glazing, as when the unit is illuminated it harmonises completely with the general decorative scheme of the roof and the auditorium.

The under-balcony units are of two types, the main central units being circular, and some 6 ft. in diameter. These are flanked by two oval units measuring some 5 ft. long by 2 ft. 6 in. wide, of somewhat similar design. This lighting is augmented by some 60 attractive demi-coupe wall brackets, also of special design, attached to the surrounding walls and pillars; these are glazed with specially tinted glassware.

The forward part of the building is of a semi-atmospheric nature, and houses a number of recessed Italian alcoves, painted with woodland scenery, flowers, foliage, and landscape views. These are beautifully illuminated by means of carefully concealed floodlighting units in batten form, and since these scenes are seemingly detached from the general decorative scheme of the hall, the effect is one of a very pleasing nature. Over the balcony is a large number of demi-coupe wall fittings. The lighting from these is enhanced by a number of charmingly-designed standards accommodating miniature water fountains illuminated by a number of colour-sprayed lamps. The whole of the auditorium lighting is dimmer-controlled by means of a single-tier dimmer bank, with six levers and individual and master control and detachable slow-motion drive. It controls 12 Schwabe 100-contact dimmers, which are operated in pairs.

For stage-lighting purposes a type C footlight, some 42 ft. long, is employed. This is fitted with silvered-glass reflectors. The lighting is arranged in four colours, and each colour is sub-divided into three sections, centre, right and left. Four 42-ft. type D battens, fig. 2, also equipped with silvered-glass reflectors, are employed. A special type of footlight, 16 ft. long, with stainless-steel reflectors, designed for vertical burning, and provided with bearings for tilting at various angles, is installed at the rear of the stage for illuminating the bottoms of back-cloths, &c. This takes the place of the usual ground rows. Two S.L. 400 stage spotlights are installed for the perches. The footlights and battens are of extra-solid construction, and are built for lasting and durable service. Two entirely new design front-of-house magazine-type arc projectors, and one improved model 100-A projector, are installed, the latter model being equipped with a number of accessories and projection attachments for special-effect purposes and lantern slides. These new projectors have the merit of being of British manufacture throughout, and are far more simple to operate than some of their complicated prototypes that emanate from abroad.

The stage lighting is controlled by a G.E.C.-Schwabe four-tier dimmer regulator, which is ingeniously contrived. Each tier comprise fours levers, complete with individual and master controls and detachable slow-motion control. It is fitted also with grand master control levers and wheels with a slow-motion worm-gear device, which permits of an extraordinarily wide range of colour gradations. This particular

Fig. 2.—Type D Stage Battens; 42 ft. Long.

form of regulator is the first of its kind to be installed in a London theatre, and controls some 48 Schwabe 100-contact dimmers.

The lighting fittings were designed by Mr. Felix B. O'Hanlon, A.M.I.E.E., the consulting engineer to the theatre proprietors.

Car Battery Standardisation in France.

The Standardisation Committee of the French Association of Motor Accessory Manufacturers has, since its formation in 1927, devoted special attention to the reduction of the number of different sizes and shapes of batteries used in connection with the electric lighting and starting installations on motor vehicles, and has succeeded in reducing the number from 120 to seven, four for 6 volts and three for 12 volts.

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A Norwegian Hydro-electric Station.

Brief particulars of some transformers which are said to be amongst the largest constructed in Scandinavia.

THE Nore power station, a large electrical undertaking recently completed for the Norwegian Government, is situated in Numedal, about 60 miles from Kongsberg at the terminus of the Kongsberg-Rodberg railway. Water is supplied to the station from the small Tunhoyd Lake, which is so situated that it has been possible by the construction of a dam to impound about 12,000,000,000 cu. ft. of water with an available head of about 1,150 ft. The initial development of the station includes four sets, each consisting of a Pelton horizontal turbine of 36,600 h.p. at a net head of 1,000 ft., running at 300 r.p.m. and directly coupled to a three-phase generator of 25,400/29,000 kVA at 11,000-12,000 volts, 50 cycles. Each generator is connected to high-voltage bus-bars through a 12,000/144,000-volt transformer of equivalent size, and between the generators and transformers only isolating switches ahe used, so that synchronisation must be carried out by the oil switches on the 144,000-volt side. When fully developed the station will contain eight similar sets, while plans have been prepared for the construction of another station, Nore II, which will take water from the tail race of the first plant.

The power from Nore is transmitted at a pressure of 132,000-volts to three sub-stations at Flesaker, between Drammen and Kongsberg; at Smestad, in the neighbourhood of Oslo; and at Slagen, near Tonsberg. Through the sub-stations the Nore station can be connected in parallel with other power systems supplying those districts. When the scheme is completed two double transmission lines will run from Nore, one direct to Smestad and the other to Flesaker and on to Slagen. To begin with the lines are single circuits, but they have a fourth wire as a stand-by. The distance from Nore to Flesaker is approximately 50 miles, and from Nore to Smestad 70 miles. At intervals of about 12 miles switching stations have been constructed where the lines are "rotated." At those stations also the reserve conductor can be connected in circuit in place of any of the three-phase lines, should a breakdown occur.

The four transformers for the initial plant are of the oil-immersed three-phase type, with three cores and simple concentric windings, and are cooled by circulating the oil through separate water coolers. The transformers are designed for a normal output in continuous service of 29,000 kVA when the temperature of the cooling water does not exceed 50 deg. F., and 25,400 kVA when the temperature of the water does not go beyond 77 deg. F. The ratio is 12,000/144,000 volts at no load, and the connection is star-delta with secondary neutral point brought out. No extra tappings are provided for voltage regulation. The h.p. winding, which is a disk coil winding with automatic pressure devices, has specially strengthened insulation between turns next to the phase terminals and neutral point.

The bushings are of the condenser type and are provided with porcelain covers. The transformers and all other apparatus are designed for a nominal transmission pressure of 132,000-volts and for outdoor erection. The cooling equipment is, however, placed indoors in the cable-ways beneath the foundations of the transformers and oil switches. For each transformer two coolers are used which, when acting together, can dissipate 280 kW when the cooling-water temperature does not exceed 77 deg. F., and 340 kW with a water temperature of 50 deg. F. The quantity of oil which circulates through each cooler is 900 gallons per minute, and an approximately similar quantity of water is used. For circulating the oil centrifugal pumps are used, directly coupled to squirrel-cage motors and designed for a water head of 65 ft. The temperature drop in the oil passing through the coolers is arranged to be 59 deg. F. at full load, the mean temperature of the oil not being more than 68 deg. F. above that of the incoming cooling water.

The usual tests were carried out on the transformers before they left the works of the builders, and the guarantees were fully upheld. The insulation was tested hot at the following pressures:—

- **Primary** winding to earth: 35,000 volts for one minute, followed by 26,000 volts for five minutes.
- **Secondary** winding to earth and primary winding: 275,000 volts for one minute, followed by 210,000 volts for five minutes.
- **Primary** bushings: 50,000 volts under rain (⅛ in. per minute at 113 deg.), 68,000 volts dry and 15,000 volts without visible corona.
- **Secondary** bushings: 265,000 volts under rain test (⅛ in. per minute at 113 deg.), 360,000 volts dry and 165,000 volts without visible corona.

The transformers are guaranteed to be capable of carrying the following loads: 25,400 kVA at 11,000-12,000 volts primary and a power factor of 95 without the temperature rise in the oil and windings exceeding 122 deg. F. when the incoming cooling water has a maximum temperature of 77 deg. F.; 29,000 kVA at 11,500-12,700 volts primary without the temperature rise exceeding 149 deg. F. and with an incoming cooling-water temperature of 50 deg. F. The weights of the transformers are: core with windings 42½ tons, tank with transport wheels 11½ tons, oil 27 tons, to which must be added approximately 15 tons for the cooling unit for each transformer. They are provided with expansion vessels, calcium-chloride breathers, Buchholz relays, dial thermometers, thermo-signalling apparatus, resistance thermometers for distant reading, mercury bulb thermometers, oil and water circulation signalling apparatus, and air separators through which the oil must pass on leaving the coolers before re-entering the transformer tanks.

As the transformers had to be transported by rail their dimensions were limited by the loading gauge and a maximum permissible load of 6 tons per wheel. It was, however, necessary to transport the core, tank, accessories, and oil separately, and a special wagon was built to enable the loading gauge to be fully utilised. The overall dimensions are 10 ft. 7 in. by 24 ft. 7 in. by 22 ft.

For the sub-station at Flesaker two oil-immersed core-type transformers have been supplied, being similar to the Nore transformers, but cooled by circulating the oil through external forced-air coolers. With a maximum surrounding temperature of 95° F. the normal output is 25,000 kVA secondary and 8,000 kVA tertiary. The three separate windings, with ratios of 123,000/61,300/5,830 volts at no load, 50 periods, are connected in delta-delta-star with neutral points brought out from the primary and secondary windings. The tertiary winding is designed for connection to a synchronous condenser used for voltage regulation and compensation of the power factor; the latter is designed for an output of approximately 14,000 kVA. The transformers are of the outdoor pattern, the cooling units being erected in a separate building placed between the two transformers.

Three transformers were supplied for the sub-station at Smestad, of the same type as those described above for Flesaker, but having the following characteristic data:—

Transformer No. 1 for connection to the Oslo electricity supply network: ratio at no load 119,200/32,635/5,580 volts, 50 periods, connection delta-delta-star with neutral points of the primary and secondary windings brought out. Transformer No. 2 for connection to the Akers electricity supply network: ratio at no load 119,200/48,935/5,580 volts, 50 periods, connected as No. 1. Transformer No. 3, which is intended as a stand-by for Nos. 1 and 2, is furnished with four windings having the following ratios at no load; 119,200/48,935/32,635/5,580 volts, 50 periods, connected in delta-delta-delta-star with the neutral point of the primary winding brought out and a common neutral point brought out for the two secondary windings, which are auto-connected.

Each is designed for a normal output on continuous service of 28,000 kVA on the secondary side and 12,000 kVA tertiary, the surrounding temperature not exceeding 68 deg. F., and without the temperature rise in the windings or oil exceeding 131 deg. F. As in the case of the Flesaker station, the tertiary winding is connected to a synchronous condenser for voltage regulation and power-factor correction, and the coolers are similar also.

The transformers described were manufactured by the Per Kure Co., of Oslo, Norway, and are claimed by the *Asea Journal* to be among the largest which have so far been constructed in Scandinavia.

Electricity in Market Gardening.

In order to ensure supplies of flowers and fruit in Scandinavia, even in the cold northern winter, electricity has been pressed into the service of the market-gardeners, and the following results have been obtained:—Seeds which normally take twenty days to germinate, in soil with a temperature of 12° C., sprout three and a half days earlier if the temperature is raised one degree only. Onion seeds will sprout a week sooner if the soil temperature be raised to 22° C., and the improvement is much the same for flower bulbs.

The most effective method in use is to place the wires underground (naturally with protective covering) at a depth of 30 cm. As the earth is a good accumulator of heat it is not necessary to use current continuously, and the latest installations are automatic, cutting off the current as soon as the desired heat has been generated.

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Electric Warming.

Notes on the various methods in vogue, with special reference to the low-temperature panel method.

By RONALD GRIERSON, A.M.I.E.E., A.M.I.Mech.E.

(*Abstract of a paper read before the* INSTITUTION OF HEATING AND VENTILATING ENGINEERS.)

MANY engineers are obsessed with the idea of efficiency divorced, or practically so, from all other considerations. It is true that a kilowatt-hour contains 3,400 British thermal units, while a pound of coke contains about 12,500 B.th.u., but electrical energy is the finished product, whereas coke is the raw material. A large section of the population is prepared to pay a little more for something that is a little better or more attractive than the cheapest, and *possibly* the most efficient.

Very briefly stated, the advantages of a well-designed, modern, continuous electric warming system are: its entire invisibility in the decorated room; its adjustable automatic temperature control; its low operating temperature, and its perfect reproduction of the atmospheric conditions of the most desirable days of early summer, *e.g.*, an evenly distributed warmth combined with a delightful feeling of fresh air. Many people have installed electric fires with current at 2d. per unit, or 6d. per hour for a 3-kW fire. The ill-advised electrical enthusiasts who are responsible for these early installations for any purpose other than for intermittent heating are really the electrical industry's worst enemies. In future, we must remove the possibility of switching-off continuous heating systems from the immediate locality of the user, and educate him to leave the installation on automatic temperature control. By this means he will obtain much more comfortable conditions and at the same time, curious as it may seem, he will have a lower bill for electrical energy.

I cannot refrain from commenting on the lack of vision exhibited by the majority of supply authorities in failing to grasp the advantage which the continuous electric warming load offers when it is operated by automatic temperature control. Surely such a load is entitled to a better rate than an electric-fire load which is principally switched on during the cold and foggy days—when the load is heaviest. Yet, in the majority of districts, one heating rate is quoted for all types of equipment, and this is not infrequently a prohibitive rate for continuous, thermostatically controlled equipment.

One or two supply authorities are offering a rate of ¾d. per unit between the hours of 9 a.m. and 7 p.m., and ½d. per unit for the remainder of the period. The average price paid at these rates for thermostatically controlled installations is not the average of 0.625d., but something very much nearer 0.55d. As a further inducement, I would suggest the payment of a fixed charge and a corresponding lowering of these rates, so that the annual total cost is approximately the same.

The following paragraph appeared in the ELECTRICAL REVIEW of October 4th, 1929, regarding the offer of a bulk supply to the Dover Corporation:—

> "According to the proposed scheme, the bulk supply would be taken from the Central Electricity Board's sub-station on Folkestone Hill at 33,000 volts, and reduced to 6,600 volts by means of transformers and switchgear provided by the Board. The supply would be metered at 6,600 volts and the price paid for the supply would be as follows: Not exceeding £3 17s. 6d. per kW of maximum demand during any half hour in the months of November and December in the year of account, plus 0.2d. per kW hour supplied, the unit charge to be subject to an increase or decrease of 0.001d. for each penny by which the cost of coal delivered to the Board stations shall rise above or fall below 16s. 6d. per ton."

As this is one of the earliest published offers of a supply from the national grid, it will be interesting to examine it with regard to the probable effect on a continuous electric warming proposition, always bearing in mind, of course, that the Board sells to the local distributor, whose distribution costs and profits must be added, and noting specially the use by the words *not exceeding*.

Consider a load of 10 kW and a consumption of 2,000 kWh per kW installed, figuring the maximum load as being 60 per cent. of the connected load; the following result is obtained:—

Connected load	10 kW.
Maximum load on mains	6 kW.
Fixed charge, 6 kW at £3 17s. 6d.	= £23 5s. or 5,580d.
Metered charge, 20,000 units at 0.2d.	= 4,000d.
Total cost	9,580d., or 0.479d. per unit.

The interesting factor of a tariff of this character is that if the consumer increases his consumption from 2,000 to 2,500 units per kW installed, he only adds, on the basis outlined above, 8s. 4d. per kW installed on his annual bill for current. In my own view, a lower fixed charge and a higher running charge would be more attractive to the consumer.

It is desirable to fix attention on one vital difference between electrical and hot-water heating. In the latter system, the maximum temperature that pipes, radiators, &c., can attain is fixed by the temperature in the flow pipe. Cover up your pipe or radiator with a blanket, and the only result is that little or no heat is emitted, and that the water leaves the pipe or radiator at the same temperature as it entered. With electrical equipment, however, the result is very different because energy is being continuously supplied to the apparatus and a steady temperature is only attained when the heat loss balances the heat input. Herein lies the danger of employing unguarded types of non-luminous heaters which are within easy reach of floor level, *e.g.*, the user may unwittingly restrict the heat loss by throwing over the heating equipment, either accidentally or intentionally, a blanket, coat or other object. Electrical devices have no final temperature and the temperature may continue to rise under the conditions named, until the ignition point of clothing, &c., is reached.

The following are some of the advantages and disadvantages of the various types of equipment available:—

Electric Fires.—Useful psychological and decorative effect; simple, convenient, and cheap in the plainer forms; quick response for intermittent heating; elements burn out and flexible conductors fail and require to be replaced from time to time; temperature gradient very severe, *e.g.*, temperature falls rapidly as distance from fire is increased, and heat shadows very marked.

Resistance-wire Convectors.—Low first cost; temperature of active parts high; "air burning" is probable.

Electric Hot-water Heaters.—Occupy floor space; soil decorations; unsightly; no labour; no boiler and pipes.

Pipe Heaters.—Floor space occupied; high operating temperature; cheap; ease of application; low temperature grade.

Plate Heaters.—Difficult to incorporate and conceal the panels.

Thermal-storage Systems.—Capital costs involved and space occupied are considerable; labour reduced to the vanishing point.

Dulrae Panel System.—Ease of incorporation in the structure; invisibility; low temperature grade; low operating temperature; perfect atmospheric conditions; elimination of labour and maintenance cost; slightly higher initial cost.

The cheapest and simplest form of low-temperature electric panel system is the embedded type, *e.g.*, insulated conductors having a comparatively high resistance embedded in plaster which is carried on a cork slab and secured to cement asbestos backboards. Standard sizes are 6 ft. by 2 ft.; 4 ft. by 3 ft.; and 3 ft. by 1 ft.; all being approximately 1¼ in. thick. The 3 ft. by 1 ft. size for use, four in series, on 200/250-volt systems, has been found specially useful for fixing between the floor joists and also for situations in which long narrow strips of warmth are desirable.

All standard panels are designed for a maximum surface temperature of 120/125 deg. F., when fixed horizontally on a ceiling and operated in still air. Under automatic temperature control, the temperature, provided adequate surface is installed in relation to the heat loss, average 85/90 deg. F., even on cold days. Loading averages 40 watts per sq. ft. of active surface, or 400 watts for the standard 6 ft. by 2 ft. or 4 ft. by 3 ft. panels.

The following are a few of the innumerable methods of control: switching of individual panels in sections of 400 watts; series/parallel switching in groups of 2, 4, or 6; thermostatic control of all panels in one room; thermostatic control of the main supply and individual switching of room panels; and several panels switched on permanently and the remainder controlled by thermostats.

In figuring on automatic control, care has to be taken in large rooms to see that the load switched has a reasonable relation to the mains of the supply authority; *e.g.*, it would probably be impracticable to switch blocks of, say, 20 kW off and on at ten- or twenty-minute intervals without a flicker in the lights being noticeable. The capacity of the standard thermostat is from 10 to 12 A at 230/240 volts, *e.g.*, from 2,300 to 2,900 watts. Where larger loads are required to be switched, additional thermostats are required, or one thermostat can be arranged to control the coil of a contactor switch, or parts of the panel may be switch controlled.

The coke- or oil-fired boiler has one great advantage over the electric method—it is always possible to force the boiler and

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thereby temporarily to increase the normal power of the installation at the expense of slightly lowering the efficiency. Once an electric system is fixed and connected to a constant-pressure system, the maximum heat emission is fixed. Therefore, it is essential to decide at the outset whether the electric system is to be boosted by means of electric or coal fires during spells of very severe weather or where abnormal heat is required, as in the event of sickness, or whether the electric system is to take care of all possibilities. Normally we figure on a 30 deg. rise for staircases, landings, halls and vestibules, and 40 deg. for living rooms, offices, bedrooms and bathrooms, unless otherwise directed

For a temperature rise of 30 deg. F. we find that the watts per cu. ft. calculated by the ordinary methods average 0.63 or, say, 22 superficial feet of panel per thousand cu. ft. of space, *e.g.*, the surface required is approximately 2.25 per cent. of the cube. For a 40 deg. rise the rating is approximately 0.84 watt per cu. ft., 30 sq. ft. per thousand cu. ft. of space, or 3 per cent. of the cube.

The cost of operating an electric warming system is no easy matter to estimate with any degree of precision, for the factors are so variable, accurate measurement is so simple, and the maintenance of the required temperature is so precise. Units are units, but all coke is not good coke, and all stokers are not good stokers. Both coke and stokers can be blamed by hot-water engineers. Electrical engineers can only blame the meter or the occupants of the building, or their own calculations.

From a London kinema equipped with the "Dulrae" panel system, the following figures have been obtained :—

Total load	...	31,500 watts, or 107,000 B.th.u.
Total cube	...	55,000 ft.
Watts per cu. ft.		0.586.
Consumption	...	Year ended March 30th, 1928—24,202 units, or 768 units per kW installed.
		Year ended March 30th, 1929—29,627 units, or 940 units per kW installed.

If these totals are figured as to 60 per cent. at the 0.75d. rate, and 40 per cent. at the 0.5d. rate (which is now available), the annual cost is £60 and £74, respectively. In this case, the animal heat of the audience is responsible to a considerable extent for the remarkably low figures obtained.

Electricity Meters.

Is there something fundamentally wrong with our methods of measuring electrical energy?

By E. W. HILL, M.I.E.E.

(*Extracts from chairman's address before* METER AND INSTRUMENT SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

ELECTRICITY meters must have been named by default on the paradoxical principle of *lucus a non lucendo*. They do not measure electricity, but energy, which, so far as engineers are concerned, is a straightforward scalar quantity. It is an *amount*, which would not seem to be awkward to measure like *rates*, or derived quantities. We ought to be able to measure it at least accurately enough to free us from introspection and continual preoccupation about possible lack of accuracy. We are obsessed with accuracy tolerances.

When measuring energy with meters do we not now conduct an operation which, for indirectness, is comparable with the following hypothetical, but possible, method of measuring a distance? Suppose that, instead of straightforwardly applying a measuring scale to determine the distance between London and Edinburgh, for example, we traversed the distance in a vehicle, the while making determinations of its velocity as it varied from time to time, and of the duration of the journey; and that we then performed a complicated integration of velocity/time, and in that way ascertained the length of the journey. That is exactly, in principle, what practically all electricity meters do. Can no way be found of substituting a direct form for the indirect one?

The interrogation may perchance stimulate someone to seek a solution, by casting aside all preconceived ideas on the subject, but, even with our present methods, another way of escape from our accuracy difficulty seems at least not definitely closed. We dare not allow our instruments to absorb the energy that is measured; electrons are caught in our instruments, made to give an account of themselves, and then allowed to pass on to their proper business of lighting lamps or turning motors, &c. They do not get through that ordeal quite scot-free; they have to do a little work; turn a disk against a little magnetic friction, and turn the wheels of a counting train. The actual mechanical work is absurdly small; so is the levy demanded for this purpose from the electron flow; that is, small in comparison with the amount actually measured, but the disproportion between these two small amounts, *i.e.*, between the electrical input to and the mechanical output from the meter is simply amazing; it is of the order of 50,000 to 1. Why cannot a meter, considered as a motor, converting electrical energy into mechanical energy, be more efficient than that? Admittedly a very small motor is in general less efficient than a large motor; a kind of anti-relativity principle reigns in this domain. In the presence of the eternal urge towards cheapness, manufacturers dare not make their meters much more efficient, in the sense I have just used the word, for the reason that higher efficiency means higher driving torque for the same watt loss; higher torque necessitates stronger permanent magnets to damp down the disk movement, so that even a modest four-fold increase of efficiency would involve a positively prohibitive cost for the necessary permanent magnets. This is, indeed, not a fanciful notion. Manufacturers cannot afford to make ordinary meters, at prevailing prices, with torques much higher than they are now. May I suggest this as the reason why meters are not made for more accuracy than they actually are?

Do we really want more accurate meters? An unqualified affirmative answer might not altogether be justified. I conceived the real function of meters to be to provide equitable and determinate means, rather than any arbitrary means (leading to approximations only) of fixing the relative amounts of individual consumers' contributions; but, under the guise of two-part tariffs, arbitrary means are becoming more and more prevalent as part at least of the modern systems of charging. Charges by assessment cannot, at least at present, be adopted to the exclusion of all other factors, mainly for two reasons, *viz.*, the risk of waste by negligent customers, and the wide diversity of capacities for the consumption of energy of different consumers. For equity's sake, exact a tariff based on accurately ascertained facts and costs, which involves, amongst other things, as a *sine qua non*, extremely accurate metering. This raises a consideration of some importance. As regards both price and watt loss, manufacturers have, figuratively, been driven down a kind of asymptotic curve. Even this statement may be too sanguine, since an asymptote implies a limiting value, and I am not sure that there is yet one in sight for this process, except by zero. However admirable this tendency may be from the users' standpoint and for its disciplinary effect upon the manufacturer in imposing upon him in respect of cost, increased efficiency of production, and in respect of low losses, increased economy in the use of material, it is a tendency containing elements of danger; one reason, among others, being that it is an undiscriminating tendency embracing all kinds of meters, large and small. A broad distinction should be drawn between small meters, in which case low prices and low losses are admittedly important features, and large meters in which those features sink into relative insignificance. The manufacturer should surely be allowed a little more margin, economic and technical, to enable him to supply a better, more accurate, meter for really important supplies; especially when so many large meters have demand-indicator attachments upon the readings of which the transfer of much money depends.

How curious it is that the exigencies of the conditions governing electrical generation and supply, combined with the efforts of the tariff builders, have imposed the necessity of providing for the automatic measurement of a quantity based upon so artificial a conception as that of an average maximum demand. It is a conception which involves a necessity unparalleled in any system of measurement other than electrical. We still await tripping apparatus endowed with prescience, capable of holding its hand, as it were, and being ready to start a resetting period just when it can foresee the immediate incidence of a period which is going to embrace the true maximum load. As though the artificiality of the maximum-demand conception were not enough, we superimpose upon it the even more transcendental idea of kVA, the problem of its measurement, and its collateral, power factor.

TABLE I.—PROGRESSIVE IMPROVEMENT OF INDUCTION METERS.

Aproximate date.	1890.	1896.	1905.	1913.	1929.
Space occupied, cu. in.	900	300	165	135	75
Total weight, lb.	80	15.5	8	4.4	2.75
Weight of voltage element, lb. ...	14	3.7	1.2	0.7	0.44
Weight of current element, lb. ...	11.5	1.5	1.2	0.4	0.28
Weight of disk, oz.	2.1	4.7	1.1	0.9	0.8

Meters are now, it may seem, much as they ever were, yet there has been definite progress on the technical side, in new designs for special purposes, in economy of material and space (a condensed summary of which is given in Table I); in elegance of construction, and, hidden beneath and underlying all, in subtleties of design.

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A French Interconnected System.

The electricity generating plant and distribution network of the Societe Electrique de la Siderurgie Lorraine.

By L. A. E. SEKUTOWICZ and A. EVAIN.

(*Extracts from a paper read at a joint meeting of the British section of the* SOCIETE DES INGENIEURS CIVILS DE FRANCE *and the* INSTITUTION OF ELECTRICAL ENGINEERS.)

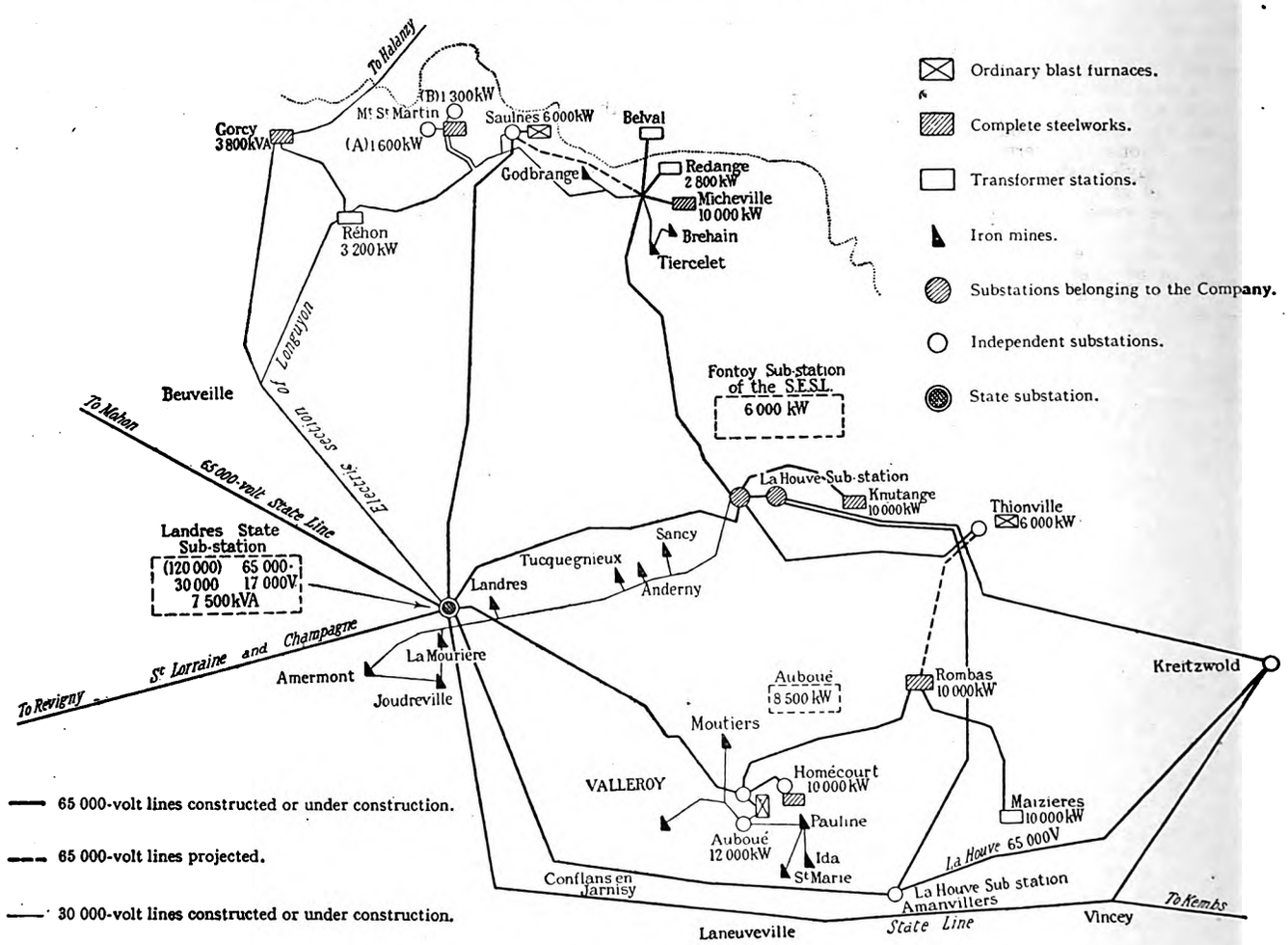
AS far back as 1918, and therefore during the course of the war, the Mining and Metallurgical Technical Commission of France foresaw the necessity for the reconstruction of the mines and works which had been devastated in the Lorraine region, and for the construction of a network to transmit electrical energy to them during the period of reconstruction. The ultimate aim was the permanent pooling of the means of production of electrical energy by running the metallurgical power stations in parallel in order to ensure the regularity and continuity of the supply of energy to the works; the transmission lines were also to be designed to allow of the sale of energy generated by surplus blast-furnace gas.

The firms which were brought under consideration comprise, at the present time, excluding the Belgian and Luxembourg works, eight pig-iron foundries (excluding steelworks) with 30 blast furnaces; and 12 complete works, with blast-furnaces, steel-producing plant and rolling mills, comprising 70 blast furnaces. These works are capable of supplying annually 7 million tons of cast iron, which corresponds to a total output of 3.6 million cu. m. of blast-furnace gas per hour.

Deducting from the above the needs of the blast-furnace services proper (the heating of the cowpers, blowers and accessories), it should theoretically be possible to dispose of 1.8 million cubic metres of gas per hour for purposes other than blast furnaces, which is equivalent to 240 tons of coal per hour. Assuming a calorific value of 7,000 calories per kg, this should produce from 300,000 to 400,000 kW, according to the system employed, *i.e.*, gas engines or turbines. If we take into account the amount of energy required for the purposes of the central stations themselves, we can estimate a surplus amount of energy available for sale of up to 100,000 kW.

The installations that have so far been completed comprise 10 works, which include 60 blast furnaces.

In order to carry out this programme the principal metallurgical companies and the Omnium Lyonnais (a firm which specialises in the industrial applications of electrical energy and was to provide the technical service of the future company) grouped together to form a technical department for the construction of future schemes, and in 1920 created the Société Electrique de la Sidérurgie Lorraine with a capital of 8 million francs. Negotiations with the Government were successfully concluded in 1924. The concession to transmit



All lines comprise 6 conductors. Capacities indicated in kW are only those of the machines actually supplying the network.

Fig. 1.—The Network and Distribution Area of the Company.

applied to the creation of an aerial ring-main at 65,000 volts tied-in to the State station at Landres, which was built earlier on the 120,000-volt line which connected some Swiss works and the works in the French Ardennes, and the network at 65,000 volts from the mines of The Houve (Fontoy sub-station). These two distribution concessions gave rights for a ring main of 30,000 volts to connect the mines (and the less important works) to 65,000/30,000-volt sub-stations, which were connected to the high-voltage network, as shown in fig. 1. The initial programme should be completed very shortly by the installation of new power stations designed to utilise the surplus gas products in each of the metallurgical works forming part of the group.

Only by adopting the programme as a whole could the advantages of the system be fully realised. During the whole of Sunday when steel production is at a standstill the total

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amount of gas production is available. During working periods there is also surplus energy, but it varies considerably during the course of an 8-hour shift, as it represents the difference between a relatively constant total production and the extremely variable needs of the steel-producing plant and of the rolling mills. The shape of the load curve resembles rather closely that of a traction system.

General parallel running attenuates very considerably the relative importance of peaks, and regularises the voltage and frequency, and so allows of a considerable increase in the production of rolled steel, which has given much advantage to the steelworks connected to the network. Furthermore, it reduces the amount of stand-by plant, as at any time and nearly everywhere at certain hours there is a surplus amount of gas. This method of running produces further energy at no cost other than that which corresponds to a reinforcement of the gas-washing plant. The very great advantage of being able to run on light load only those generators whose efficiency is satisfactory under these conditions has not been lost sight of, and the possibility of the mutual interchange of power in the case of accident is of further advantage to the system. But, however advantageous the recuperation of energy during working hours may be, the utilisation of the energy which can be produced by employing waste gas, particularly during the change-over periods, is even more important. Labour off-periods are grouped during the night when the available energy is difficult to utilise on neighbouring distribution networks. In order to obtain a market for the surplus, it is necessary to feed a very large area in such a way that some steam power stations may close down entirely during the night.

Some fear that operation would be difficult in practice was based on the irregularity of the generating sets (4-stroke blast-furnace gas engines with either two or four single- or double-tandem cylinders). The relative importance of peaks decreases with the number of interconnected production centres, and it was therefore sufficient to connect such engines together by a sufficiently small impedance, and to run the machines under conditions which would approach parallel running with short connections from terminal to terminal. The impedance of the company's 65,000-volt lines is of the order of 0.42 ohm per km., and experience has confirmed this view. For the secondary networks, after a period of indecision, the company decided to adopt a voltage of 30,000, and practice has entirely justified the choice of these two voltages.

The factor of safety of the insulators was made sufficiently high to avoid the risks of perforation, even at a voltage much in excess of the flash-over voltage. In the sub-stations, surge protective gear was limited to the adoption of shunted inductance coils connected to each outgoing feeder, and transformer insulation to earth was very high (sufficient for three times the working voltage) and the insulation between turns was designed to withstand the full working voltage. Thus the insulators work rather effectively as voltage-limiting devices, although this is not their rôle. However, the lack of selective protection has made itself felt and is now under consideration, as is also the general earthing of the neutral, and the methodical reinforcement of insulators in the more exposed regions.

With regard to the sub-stations, the outdoor type was adopted from the beginning. In spite of the production by certain works of conducting dust in very large quantities, this system has not given rise to accidents in operation, and has effected certain economies in building up the network, which might have been paralysed at its inception by the financial crisis of the franc. The works sub-stations (65,000/6,000 volts) are simply liaison sub-stations for the network, and at the same time serve as disconnecting or by-passing sub-stations, and can be disconnected from the circuit without interrupting the continuity of the ring. Although the first core-type transformers have given entire satisfaction, the company is experimenting with the shell type, which appears to be stronger and to withstand the effects of short-circuits more effectively.

The distance between the furthest stations does not exceed 60 km. Of the 15 stations situated in the French part of the mining area, 10 are connected to the network. The total amount of power of the latter is of the order of 125,000 kW, but all the units are not permanently connected to the network. The machines are as follows:—

5 gas 4-cylinder engines	22,000 kW
20 gas 2-cylinder engines	50,000 kW
15 turbo-alternators	45,000 kW
6 convertor groups connecting up works which run on d.c. ...	9,200 kW

(The total power of the d.c. works is approximately 30,000 kW).

The total power connected to the network is therefore supplied by 40 miscellaneous units, in the following proportions: gas engines, 56 per cent., steam turbines, 36 per cent., and convertors, 8 per cent. If we include the generating units in the stations supplying the convertors, the proportion of steam turbines drops to 32 per cent.

In the first period of its development (1920-1923) the company concentrated on the interconnection of mines in order to facilitate pumping. To this end it constructed sub-stations and local lines at 30,000 volts. In 1924-1927, after having adopted the general plan of the network, 65,000-volt lines were constructed, and at the beginning of 1928 the majority of the larger works of the company were connected together. The third period (1928-1929) began with duplicating the lines, which were still provisionally of the 3-wire type, and completing the ring. In 1929 a new and greatly extended programme was established, including the installation in the eight principal metallurgical centres of high-pressure turbo-alternators. When this programme is completed more than 45 million francs will have been spent by the company on lines and sub-stations, without taking into consideration the installations that have been carried out on the members' own premises (which amount to 63 million francs for new units only), a total of nearly 100 million paper francs (the gold value of which varied during the course of the work) having been invested in the scheme.

Since 1926 the Lorraine metallurgical group has been connected to the distributing network of the Lorraine Electrical Co., fed by a steam power station of 50,000 kW at about 140 km from Landres. It already runs in parallel with a group of Swiss hydro-electric power stations. In the ordinary course of events the operation of these stations is eminently satisfactory. In particular, the normal variations of load have never given rise to any difficulty in maintaining the normal voltage at the points where the supply is used, nor has it been necessary to install any synchronous condensers or induction regulators.

Peaks of short duration, but of a periodic character, give rise to a certain amount of hunting, which would not occur if all the units were in a perfect state of maintenance and if they were automatically tripped out as soon as their running became irregular. It is hoped to achieve this result by means of reverse-power relays. An examination of this phenomenon by one of the authors' colleagues is summarised in the paper.

The difficulties encountered are not sufficiently serious to cause the advantages of parallel running in general to be lost sight of. By increasing the total interconnected power to its maximum the relative importance of disturbances is diminished, peaks are reduced, and loss of gas becomes a minimum. But in the present state of the art and with a view to giving the maximum satisfaction to the consumers, the company takes advantage of the existence of 6-conductor lines over the whole of its network, and provisionally runs two distinct circuits. The first interconnects pure blast-furnace works and runs in parallel with the large neighbouring supply companies. The second connects the steelworks to its network and consequently is subject to variations in voltage and frequency of a much higher order; these are, however, very much smaller than they were before interconnection was adopted. The overall efficiency of the installation is thereby greatly improved, and the production of finished metal is increased under conditions which would themselves almost justify the enterprise.

It is easy to determine the principles on which the commercial relations of a group of consumers and producers of electrical energy should be based, but difficult to establish a fixed plan. For instance, the treatment of its participants should be on a basis of rigorous equality, but when the elements upon which it should be based come to be defined divergencies of opinion appear. The Union des Centrales de Liége allowed its producers a certain amount of competition, but assured to each of them an equal profit, whereas the Metallurgical Company did not take into consideration the profit accruing to its participants for the sale of their energy, but guaranteed that every participant should receive equality of treatment as regards quantity and price.

The Union des Centrales de Liége functions as a co-operative society, whereas the Lorraine metallurgical group functions as a clearing house. The Union supplies through its network industries of very diverse natures: some producers and others consumers; the service rendered by the Union by taking energy from the former and delivering it to the latter has therefore a very particular characteristic; the operations of buying and selling are confined to the co-operative partners and thus lose all commercial appearance. The Lorraine metallurgical group, however, supplies through its networks, almost exclusively, metallurgical concerns which are producers of energy; in this case it is not purely a question of mutual exchanges between the participants.

The load dispatcher is situated in the centre of the network at Briey, and has power to control the running of machines, if necessary; in particular he can have any machine stopped which causes disturbance in the network, and he can also order another machine to be connected to a network, provided one is available. He arranges the running of machines and, in particular, the supply of wattless current. In his office there is no apparatus for measuring energy, but only hand-operated panels which show him the state of affairs at every part of the network, and the condition of the machines in the various stations; in addition, he is connected by telephone to all the switching and central stations, and periodically receives information as to the running of the network. His task is, in fact, to ensure continuity of service.

The central stations which have been connected to the network had been designed to cope with the internal needs of the works, and not to the possibilities of production by blast-furnace gas. In consequence, in nearly all the works belonging to the company there was a surplus of gas not utilised, which constituted a source of energy of about 50,000 kW. In order to exploit this, it was necessary to install in every works the means of production. The question was whether gas engines or steam turbines should be installed.

The defenders of the gas engine admitted that it lacked elasticity, and was not suitable to deal with such an irregular consumption as that of a rolling mill. They therefore added

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to their gas engine a turbine partially fed by steam produced by exhaust boilers, thus regularising the running of the gas engine by means of the turbine in such a way as to absorb the peaks and to increase the thermal efficiency of the installation from 23 to 26 per cent. (for engines without scavenging), whereas a steam turbine fed by high-pressure boilers had an efficiency of 21.6 per cent. Translated into cubic metres of blast-furnace gas, these figures gave the following consumptions:—

Gas engines with regenerative boilers—3.8 cubic metres of gas per kWh at the terminals.

Steam turbines with high-pressure boilers—4.6 cubic metres of gas per kWh at the terminals.

In other words, 100 cubic metres of blast-furnace gas would give with gas engines 26 kWh, and with turbines 21.7 kWh. Therefore the gas engine shows an efficiency in kWh which is 20 per cent. better than the efficiency of the turbine. In spite of this advantage, which is to a very great extent compensated by the high cost of manufacture and operation, the use of turbines has been adopted in order to reduce the proportion of gas engines running in parallel on the network.

At the present time the power produced by gas engines represents 56 per cent. of the total in interconnected stations; the importance of the turbines which are running is too small to enable a practically constant frequency to be maintained. The new installations will reduce the above figures to 40 per cent. and will give the turbines a preponderating effect, without which the network would be liable to cause disturbances in neighbouring networks. The author does not condemn the gas engine, which, under certain conditions, more particularly in connection with isolated works, may be preferable to the turbine on account of its higher efficiency. Turbine central stations are at present being installed in seven works belonging to the group. Their total power will be 64,000 kW distributed over seven turbo-alternator units, five being of 10,000 kW and two of 7,000 kW. Each station will comprise one group only, but provision has been made for installing eventually a second unit, which most probably will be of a more powerful type. The steam characteristics are a pressure of 35 kg/cm² (497 lb./sq. in.) and a superheat of 425 deg. C. In works which have coke furnaces at their disposal, burners are provided for employing blast-furnace or coke-furnace gas, either together or separately. Automatic regulators in each boiler will maintain a constant pressure of steam and will not call upon the coke-furnace gas until the whole of the blast-furnace gas has been utilised. It would appear to be the practice of the future to install steam generator units of a capacity such that the whole of the output of blast-furnace gas can be utilised at any moment, and to allow the boilers to feed a high-power turbo-alternator set designed with a heavy overload capacity. The works which produce their electricity with a single machine should have means of stopping periodically, and at the same time allowing their gas to be utilised by other sets. A 10,000-kW group costs less to install than a 2,500-kW gas engine. In most cases overload can only be obtained by using fuel which is independent of the works, and this fuel can only be pulverised fuel. In the new steam stations of the company each of the five units of 10,000 kW is designed for an economical load of 8,000 kW and for a continuous overload of 12,000 kW in four of the stations. The supplementary load of 4,000 kW can be obtained exclusively with pulverised fuel. The stoppage of one of the turbines can therefore be entirely compensated for by forcing the others with, if necessary, the utilisation of pulverised fuel until the station in which the stoppage has occurred has put its reserve units into service.

The conclusion is that the Lorraine Metallurgical Company has solved the problem put to it, and exchanges of energy have exceeded the figure which was predetermined at the outset as being necessary in order to make a sufficient return on the capital invested.

The number of kWh transmitted by the network of the company from the commencement, is as follows: —

1923	...	...	...	...	7,931,074
1924	...	...	...	...	22,413,015
1925	...	...	...	...	36,555,028
1926	...	...	...	...	65,703,130
1927	...	...	...	...	89,732,038
1928	...	...	...	...	112,403,727

In 1929 the total production will reach 130 million kWh, and in 1931 will exceed 200 million kWh. The amount of energy taken into account, which has been almost entirely produced by waste gas, represents annual receipts of the order of 20 million francs. However, new stations which will be in service during 1930 will considerably increase the amount of energy available, and will permit the company to increase its radius of action. When that occurs new markets will have to be found, more particularly for utilising the energy available at night. In order to ensure new outlets for the increased production of energy, the company has already interconnected two large distribution networks in Alsace and Lorraine and in the Vosges, and has participated in the creation of two new companies which are constructing high-pressure lines to join up with the Parisian region and the north of France *via* the Ardennes.

Discussion in London.

Mr. ROGER T. SMITH read an abstract of the paper, which was printed in English, and the president of the British section of the Société des Ingénieurs Civils de France spoke briefly of the benefit of such joint meetings.

Four speakers only took part in the discussion; the meeting lasted just an hour.

Mr. SCOTT MACKENZIE, chief electrical engineer of the Staveley Coal & Iron Co., Ltd. (an illustrated description of which undertaking will be found in our December 13th, 1929, issue) agreed generally with the authors' conclusions. The Staveley Co. used three 5,000-kW gas-engine sets consuming blast-furnace gas of low calorific value. Such plant was somewhat costly: about £22 per kW, including some gas-cleaning plant, against about £13 per kW for turbine sets. He had had some trouble with the exhaust piping and boilers, but the engines themselves had not given trouble. The gas engines could not, however, be started and stopped as often as turbines could; the gas engines were allowed to run as long as they would, normally about 12 weeks, at full load continuously, load variation being taken by the turbine sets. Turbine plant should preponderate, preferably in the ratio of 75 per cent. to 25 per cent., and he fully agreed with the authors' statements on the subject of hunting.

Mr. ROGER T. SMITH said it was not clear from the paper whether variation of working shifts to fit the power load was an accomplished fact or not. The authors had not said much about safety; how frequently were breakdowns experienced? One naturally did not care to mention one's troubles, but such information was valuable to other engineers. The Staveley Co. did not provide selective protection for its lines, only for the generators.

Major T. RICH pointed out that the system described was another instance of the development of power, not according to the amount required, but to that available. He envied France her spirit of co-operation: whether in agriculture or engineering, her people seemed to work together naturally without outside interference. Britain, perhaps, went too far in seeking thermal efficiency, and had to pay for it in capital outlay. Where violent fluctuations in the steel market were not allowed to take place it was easier to produce power from blast-furnace gas. In view of the extraordinary elasticity of modern steam turbine sets, had the authors considered steam storage?

Mr. L. A. E. SEKUTOWICZ replied briefly in French.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Electricity Supply.

On December 11th, in the House of Commons, Mr. HOPKIN (Lab., Carmarthen) called attention to the question of electricity supply; and moved:—"That this House welcomes the progress which has been made by the electricity supply industry and assures the Government of all support in any efforts it may make to secure the utmost possible efficiency in the generation and distribution of electricity and to make available a cheap and abundant supply of energy for all industrial and domestic purposes, particular regard being paid to the needs of the rural areas and to the close relationship which should exist between the coal-mining and electricity supply industries; and this House is of opinion that electricity supply constitutes a public utility service so vital to the needs of industry in general and to the national welfare that it should be organised on such a basis that national economic interests will be paramount." He pointed out that, during the last ten years, this country had made enormous progress in electrical development. Capital invested in electricity supply rose from £342,000,000 in 1925 to £462,000,000 in 1928, while in the latter year we exported electrical machinery and apparatus to the value of £18,600,000. In 1920 we had 5,000,000 kW of generating plant, which increased to 8,860,000 kW in 1928. In the same period the energy produced increased from 9,000,000,000 kWh to 14,960,000,000 kWh. But the progress made in electrical development by other countries had been greater, mainly because they had done so much in industrial electrification. The greatest line of development in this country was to be found in connection with the rural areas, and he regretted that there was not a single word to be found in the White Paper on unemployment, just issued, on this subject. The Electricity Commissioners should have the power to force an electrical company in a town to go out into the rural areas with supplies. There was also a large field for development in the electrification of the main line railways.

Mr. WELLOCK (Lab., Stourbridge) who seconded, urged that the situation should be reviewed in order to see whether there should be increased public control. Consumers derived more advantage from municipal than from private distributors. The nature of the finance of the big combines and holding companies, such as the Greater London and Counties Trust, made it impossible for the people in the areas covered by those companies to receive cheap electricity. Every company should be brought under review by the Electricity Commissioners or some special committee appointed for the purpose. The issue of bonus shares by distributing companies should be prohibited, and facilities should be afforded for the constitution of joint holding boards where the local authorities wished to take over the complete control of the electricity undertakings in their area.

Lt.-Col. ASHLEY claimed that since the passage of the Act of

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1926 they had done their best with a very difficult task. He thought the Act would lower costs. Referring to the campaign for the preservation of rural amenities, in his view some of the people in their letters to the Press were taking up an impossible position. If their wishes were carried out there would be no electricity in the countryside at all.

Mr. MACPHERSON (L., Ross and Cromarty) called attention to the rejection by a Select Committee of the House of Lords of the preamble of the Grampian Electricity Supply Bill. In his opinion there was something wrong in this.

Mr. HERBERT MORRISON, the Minister of Transport, agreed that the rejection of the Grampian Bill was not without its lessons, and it must be taken into account by any Government and any Minister of Transport in considering future legislation He welcomed the resolution. The problem of the industry was that, while gas could be made and stored until someone wanted it, electricity could not be stored. Therefore, electricity must be generated substantially at the time it was demanded; and as the demand for electricity varied during the 24 hours of the day, according to the activities of the community, there was inevitably much waste. Accordingly, the Act of 1926 laid down the principle that the Nation must control the generating plant of every electricity undertaking, using also the less efficient stations as subordinate generating plant, and gradually wiping out of existence stations that were not really required. If the industry had been based on that principle from the start, the country would not be faced with the present problem. After reviewing the progress already made under the 1926 Act, Mr. Morrison said this great development of large interconnected national stations would lead to a national organisation and national generation. Other stations were becoming interconnected, including many London stations. There was in hand the Central Scotland scheme for converting to 50 cycles, which was going to cost £3,194,250; the Central England scheme, costing £3,653,500, and the North-West England scheme costing £399,500. With regard to rural electrification, the development of electrical supply in the most economical way must not be allowed to interfere more than was necessary with the amenities of the countryside. The inhabitants of rural areas had to be convinced that electricity would do all that was claimed for it. He was anxious to increase the number of experiments, so that these people might see rural electrification in operation. Also, they must do all they could to solve the problem of wayleaves and overhead lines, and he hoped that landowners would co-operate with the Electricity Commissioners in that matter. Although it was a great misfortune that the coal industry and the electrical industry had not grown up hand in hand, all the talk about generating electricity at the pit-head and transmitting it over long distances, had better be accepted with reserve until the actual financial and economic facts had been looked into. At the same time, it was desirable that there should be a reasonable relationship between the two industries, and he was informed that a joint committee had been set up by the Central Electricity Board and the Coal Mining Association to investigate the situation. Careful inquiries and scientific investigations were still proceeding into the possibility of generating electricity from the Severn. Undoubtedly, water power supply was a possibility which ought to be carefully examined.

He hoped that the electrical supply industry, which was one of the most progressive industries in the country, would reject the policy of high prices, quick profits and a quiet life. The Government had issued a circular to the industry making suggestions, and there were signs that the industry was making a response. Rapid development was required in order that the capital might be used in the most effective way. They would have to face the question whether this service could be safely left partly in private hands or should be taken into the hands of the community and used definitely for the national good. The industry was so vital to the nation that it might be desirable that it should be run as a public utility service, with proper business management and commercial instincts.

Sir PHILIP DAWSON (U., Lewisham, W.) who supported the motion, referred to what he described as "the very wonderful work" carried out in a comparatively short time, by the Central Electricity Board. He did not agree that railways should be outside the scheme. He believed that under ordinary working conditions, sections of main line railway where the traffic was such as to justify electrification would be able to purchase their energy in bulk from the Central Electricity Board at prices well below .4d. Cheap overhead lines were essential if rural demands were to be supplied. He suggested that the Government might guarantee the interest on the capital provided for electrification in any industry, provided it was satisfied that the undertakings would become self-supporting in a reasonable time.

Mr. GEORGE BALFOUR (U., Hampstead), who also supported the motion, refuted the suggestion that municipal control was better and cheaper than private control, and that the prices charged by private undertakings were necessarily too high.

After further discussion, the motion was unanimously agreed to.

Electricity Areas.

On December 11th Mr. EDE asked the Minister of Transport if he would state the areas which were covered by Joint Electricity Authorities and Joint Advisory Boards, respectively, in Great Britain; what proportion these were to the total area of Great Britain; and would he give similar statistics based on population.

Mr. HERBERT MORRISON said that the four areas which were covered by Joint Electricity Authorities were London and Home Counties, North Wales and South Cheshire, West Midlands, and North-West Midlands. The areas covered 7,560 square miles, or 8.5 per cent. of the area of Great Britain, and included a population of 10,307,000 or 24.3 per cent. of the total population. The four areas which were covered by Joint Advisory Boards or Committees were South-West Midlands, South-East Lancashire, East Midlands, and Mid-Lancashire. The areas covered 4,636 square miles or 5.3 per cent. of the area of Great Britain and included a population of 6,818,000 or 16 per cent. of the total.

Wayleave Agreements.

On December 11th Lt.-Col. RUGGLES-BRISE asked the Minister of Transport if he would give a definite interpretation of Clause 13 of the draft form of wayleave agreement issued by the Electricity Commission and, in particular, state whether that clause was an over-riding clause whereby rights saved to undertakers extended to the case of land required by the grantor for any of the purposes set out in Clause 9.

Mr. MORRISON said that the document referred to was merely a provisional draft which had been circulated for the consideration of the parties interested. The Electricity Commissioners were prepared to consider any observations received. He understood that the intention of the Commissioners was that the rights saved by Clause 13 of the document should not extend to land required by the grantor for any of the purposes set out in Clause 9.

The Coal Mines Bill.

The text of this Government Bill was published last week. It contains provisions for the establishment of coal-marketing schemes under the supervision of a Central Council and District Executive Boards, formed by the coal owners; the reduction of hours to 7½ per day from April 6th; the setting up of a National Board to deal with wages, hours and conditions in the industry; and the appointment of National and District Committees of Investigation, upon which consumers will be strongly represented, to make recommendations to the Board of Trade with regard to any matters which it considers detrimental to the public interest.

Legal.

Oxford Corporation v. Oxford Electric Co., Ltd.

Mr. JUSTICE BENNETT in the Chancery Division on December 11th commenced the hearing of an action by the Corporation of the City of Oxford against the Oxford Electric Co., Ltd., claiming a declaration that by virtue of the Oxford Electric Lighting Order, 1890, and a notice given in December, 1928, the Corporation was entitled to purchase and the company was bound to sell its undertaking as from the date of the notice. The Corporation further claimed that the price to be paid was to be fixed by ascertaining the amount of the company's capital as shown by its books to have been properly expended upon the undertaking at the date of the notice, and calculating its income at £5 per cent. on that capital, and then capitalising the income by multiplying it by the appropriate number of years purchase. To find the number of years purchase the Corporation maintained that the value of money at the date of notice to purchase had to be taken. It further claimed that it was entitled to the profits of the undertaking as from the date of the notice. Finally, the Corporation asked for specific performance of the defendants' obligation to sell the undertaking and for an inquiry to ascertain the price payable in Corporation stock. The company said that the statement of claim disclosed no facts or circumstances upon which the Court could make the declaration asked for, and counterclaimed for a declaration that the undertaking which was purchaseable by the Corporation did not include the defendants' works, premises, appliances and plant outside the city area defined in the 1890 Order. The company further sought a declaration that the profits of the undertaking would not belong to the plaintiffs until the completion and payment of the purchase price.

Mr. Tyldesley Jones, K.C., and Mr. Wilfrid Hunt appeared for the Corporation, and Mr. Wilfrid Greene, K.C., Mr. Craig Henderson, K.C., and Mr. Ronald Burrows for the company.

Mr. TYLDESLEY JONES, K.C., for the applicants, said that the city had been extended by Act of Parliament since the date of the original Order. The defendant company was authorised to supply electricity in both the old and the later area. The Act expressly provided that nothing was to affect the rights of the Corporation to purchase the electricity undertaking. In 1892 the defendant company constructed a generating station in the old city and laid mains. In 1924 it extended its mains into the area which had been added to the old city. In 1928 the City Council resolved to purchase the electricity undertaking at a price to be ascertained, in accordance with the 1890 Order, and the Electricity Commissioners gave their consent to the purchase. In reply to the Judge, Mr. JONES said the approximatte number of years purchase would be fixed at the inquiry which he would ask his Lordship to direct.

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Mr. GREENE, for the defendant company, said that he took the view that the question would not arise.

His LORDSHIP said he understood that the defendants were saying that plaintiffs had to pay 20 years purchase of the net profits.

Mr. JONES replied that that was so. The Corporation said it should be 5 per cent. per annum on the capital of the company properly shown to have been expended. That meant the profits of the undertaking were to be taken for this purpose at 5 per cent. per annum. That would be a very reasonable profit at the date of the original order (1890). Electricity undertakings were not entitled to make unlimited profits. If the defendants were getting an excessive return on their capital the Corporation was entitled to apply to the Minister to make an order reducing the charge to bring profits within reasonable limits.

The hearing was continued on December 12th, when Mr. WILFRID GREENE, K.C., for the company, said the term "capitalised net profits" was used in the 1890 Order, and it could only refer to something real and not to something imaginary. If they took an imaginary rate of profit of five per cent., how could they describe that as net profits? What plaintiffs were contending for was not the capitalisation of net profits, but the capitalisation of a purely imaginary figure of five per cent. Mr. Tyldesley Jones had assumed that the Legislature intended to treat five per cent, as a reasonable return in 1890. But in that year electric lighting was in its infancy, and people would not expect five per cent. profit from such an investment. It was clear the basis on which the plaintiffs were proceeding was that less than 20 years purchase was the proper price. Five per cent. to-day from an electric lighting undertaking would not be sufficient for the ordinary investor. If the construction of capital expenditure put forward by Mr. Jones were to prevail, it would mean that over £111,000 of capital expenditure would pass to the Corporation without its paying anything for it.

The hearing was concluded on December 13th.

Mr. GREENE further said that it was inconceivable that the law would lay it down that every penny earned by the defendant company while carrying on as trustees should go into the pockets of the Corporation. The purchase price should be calculated on the profits down to the date of the notice, because the capital expenditure on the basis of which the purchase price was to be asertained was capital expenditure down to the date of the notice. If after the date of the notice defendants laid down a main, that was something outside what they contracted to sell. What the Corporation was buying was the undertaking as it existed on December 3rd, 1928, that undertaking being liable to a compulsory increase after that date at defendants' expense. The addition which had been made by the defendants since the date of the notice could not be severed from what the Corporation had to purchase.

Mr. TYLDESLEY JONES, replying to Mr. Greene's case, said it meant that capital expended in the outside areas of Oxford which was not remunerative was to be taken as earning the same profits as capital expended in the densely occupied city of Oxford itself.

Mr. Justice Bennett reserved his judgment.

Alleged Fraudulent Consumption of Electricity.

AT the Ipswich Police Court last week, John G. Pateman was charged with the fraudulent consumption of electricity from the Corporation supply.

A solicitor for the prosecution said that when the defendant's electricity meter was examined it contained a shilling, two foreign coins and a metal washer. Four shillings' worth of electricity had been used. The practice was becoming prevalent in Ipswich, and that was why the case was brought to the Court.

A meter reader and an inspector gave corroborative evidence, but the latter stated that on previous occasions when spurious coins had been found in the meter Mrs. Pateman had repaid him.

The magistrates decided to dismiss the case, but issued a warning to the public not to follow this practice.

Birmingham District Power and Traction Co., Ltd.

IN the Chancery Division last week, Mr. Justice Bennett approved a scheme of arrangement with regard to the company's capital.

Counsel for the company said that it was proposed to consolidate the preference and ordinary shares into shares of one class, with equal rights in the event of a winding-up. It was also proposed to distribute one bonus share for each share held.

Popularity of Electrical Appliances.

In the last test made by electrical societies in Oslo to find out which electrical appliance the Norwegians considered most useful, the following results, in order of voting, were obtained: 1, irons; 2, cookers; 3, cleaners; 4, heaters; 5, bath-heaters.

The Electrical Company of Oslo had offered 18,000 crowns' worth of prizes in the form of current free of charge, and the electrical shops offered electrical apparatus to the value of 3,000 crowns, making the total prize equivalent to 31,000 crowns.

Correspondence.

Correspondents should forward their communications as early as possible. *No letter can be published unless we have the writer's name and address in our possession.*

Standardisation of Sizes of Advertisement Pages.

We have been very glad to see the correspondence in your columns on this subject, as it is one on which we feel very strongly. One of the great difficulties of the engineering advertiser has been that his preparatory charges were so disproportionate to the actual cost of space, due to the fact that while a "national" advertiser could repeat his advertisement in paper after paper, the engineering advertiser had to have fresh blocks and perhaps even a new drawing for almost every medium.

Undoubtedly, such a concerted movement for a standard page size will involve many difficulties for the trade journals themselves, but we are sure that they will meet these difficulties in a sympathetic way, bearing in mind that such a reduction in the preparatory charges will release a certain amount of money for expenditure on actual space.

We greatly hope that in a vast majority of cases it will be possible to standardise on the size of 10 in. by 7 in. without making use of the two alternatives put forward.

Brookhirst Switchgear, Ltd.,
H. M. GOODY, *Publicity Manager.*

Chester, *December 13th*, 1929.

We understand that you have recently received from the Incorporated Society of British Advertisers a letter regarding proposals for the standardisation of the advertising page size in British trade and technical journals to the three sizes: 11½ in. by 8 in., 10 in. by 7 in. and 9 in. by 6¼ in. We are heartily in favour of these proposals.

Eversheds & Vignoles, Ltd.,
A. W. SWAN,
Publicity Department.

London, W.4. *December 13th*, 1929.

The All-electric House.

Referring to Mr. W. T. Wardale's letter in your December 6th issue, of late I have been going into the question of relative costs and proved a few details.

A good coal fire burns about 5½ lb. of coal every two hours, with coal at 46s. a ton or ¼d. per lb. This works out at nearly ¾d. per hour, and is attended by dust and smoke when the wind is in the wrong quarter.

The following estimates are based on the charges given below:—Electricity, lighting, 5d. per kWh; heating, 1d. per unit. Gas, lighting, 9½d. per therm; heating 8¾d. per therm.

Gas fires (I lived in a house for some months where we had seven) averaged out at 1½d. per hour. Electric fires cost 1d. 2d. or 3d., according to the size of fire.

I found, as Mr. Wardale evidently did also, that gas fires, although warm and convenient, produced sleepiness. For ordinary room lighting, a 100-watt electric lamp costs ½d. per hour, but gives greater illumination than the inverted incandescent light (gas), which costs 1d. for four hours. A 60-watt electric lamp gives 16.6 hours per kWh, practically 3.3 hours for 1d.

As regards hall lights, a 15-watt electric lamp gives 13.3 hours for 1d., whereas a small inverted incandescent gas light gives 12.5 hours for 1d., but it can be turned down, and kept ¼-full-on giving 16 hours for 1d. The difference here is that the gas even when fitted with a protective "bell" discolours ceilings.

As regards cookers—to cook for 5 persons—the oven portion costs with gas 1½d. per hour, and with electricity for the same number of people 1¾d. per hour.

The above shows that electricity compares favourably with gas, especially when cleanliness is considered and taken into account.

Thos. Barton, B.Sc., A.M.I.E.E.

Wigan, *December 7th*, 1929.

My Electric Home.

I have used the following apparatus in my home for the last 12 months: cooker, storage water heater (for all domestic water supplies) thermostatically controlled throughout 24 hours, refrigerator, kettle, iron, toaster, vacuum cleaner, four radiators, and sundry other small heating apparatus.

No gas or coke is used, and not more than 30 cwt. of coal for room-warming in severe weather.

For the last 12 months my wife and I have used a total of 4,450 units, costing £16, at an average price of ¾d. Thus, for about 6s. per week, we have all the advantages of electricity. The cleanliness and convenience alone are worth at least a quarter of the above sum, and I gladly spend it rather than suffer the smelly fumes, dirt, and general inefficiency associated with all other forms of heat.

That is the point that so many seem to miss, including engineers who should know better. Electricity is a totally different form of fuel from others and is not comparable on a heat basis. There are numerous collateral advantages of electricity that the others do not possess. No matter what the

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application is, these advantages are worth a considerable proportion of the total cost. Some people will wallow in dust and fumes and suffer endless inconvenience and discomfort to save some paltry sum. Get them to realise the true value of the cleanliness, convenience, and efficiency of electricity, and they will use it freely.

Sales.

December 11th, 1929.

A Demand for Shoddy Materials.

I think the following extract from a letter received by us a short time ago will interest you, because it certainly appears that a fair amount of electrical material used in connection with certain building contracts is of very questionable quality.

"We shall be pleased to hear from time to time if you get any job electrical stuff, we get a lot of Council houses and we have to cut very fine to secure these contracts, so that a little job line now and again helps the thing through. Thanking you in anticipation."

It would be rather interesting if we could have some idea of the names of the various Councils which, by price-cutting, or disregarding price-cutting, allow this sort of thing to go on. The original letter is available for inspection at our office.

Bromley-Langton Electric Wire and Insulator Co., Ltd.,

F. C. LANGTON, *Director.*

London, W.1, *December 10th*, 1929.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1928.

14,782. "Apparatus for effecting a graphic recording accompanying the electrical impulse transmission, more particularly for automatic or semi-automatic telephone apparatus." A. H. Marks and P. Russell (legal representatives of E. C. R. Marks, deceased). (Automatische Fernsprech-Anlagen-Bau-Ges.). September 18th, 1928. (321,466.)

15,033. "Electric communication cables." Standard Telephones & Cables, Ltd., E. Kaempf, and D. P. Dalzell. May 22nd, 1928. (321,947.)

15,066. "Electrically-circuited direction-indicators of the illuminated type for motor vehicles and the like." H. Hibbert. May 23rd, 1928. (321,963.)

19,944. "Coating metallic or non-metallic bodies with chromium." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). July 9th, 1928. (321,914.)

20,420. "Electric discharge tubes." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). July 13th, 1928. (321,915.)

20,519. "Electric safety lamps, particularly miners' hand-lamps." Ceag, Ltd., G. I. Harris and T. Knoyle. July 14th, 1928. (Patent of addition not granted.) (321,949.)

22,971. "Systems and apparatus relating to television picture transmission, telekinematography, and the like." D. N. Sharma. August 9th, 1928. (Cognate application 23,410/28.) (321,935.)

24,044. "Apparatus for starting synchronous dynamo-electric machines." I. L. Matabon and C. M. Foucault. August 22nd, 1927. (296,003.)

24,067. "Electromagnets with rotary armatures." Akt. Ges. Brown, Boveri et Cie. August 25th, 1927. (296,091.)

24,145. "Metering arrangement for telephone systems." Standard Telephones & Cables, Ltd. (G. Deakin). August 22nd, 1928. (321,956.)

24,146. "Methods of producing magnetic materials." Standard Telephones and Cables, Ltd. (Western Electric Co., Inc..) August 22nd, 1928. (321,957.)

24,191. "Telephone systems." Associated Telephone & Telegraph Co. August 27th, 1927. (296,304.)

24,250. "Combined portable wireless set and gramophone." A. Compare. August 23rd, 1928. (321,979.)

24,329. "Automatic and semi-automatic telephone exchange systems." Standard Telephones & Cables, Ltd., and E. P. G. Wright. August 23rd, 1928. (321,983.)

24,331. "Driving electromotor for talking machines." W. Löffler. August 23rd, 1928. (321,984.)

24,334. "Automatic switches for use in telephone or like systems." Automatic Telephone Manufacturing Co., Ltd., S. R. Smith and J. E. Ostline. August 23rd, 1928. (321,985.)

24,441. "Telegraph receiving systems." W. E. Beatty (Bell Telephone Laboratories, Inc.). August 24th, 1928. (321,990.)

24,665. "Rheostats of the grid type." E. Y. Walsh. August 28th, 1928. (321,996.)

24,943. "Electric transformers." British Thomson-Houston Co., Ltd. September 2nd, 1927. (296,446.)

25,410. "Electrical connecting devices." Igranic Electric Co., Ltd. (Pacent Electric Co., Inc.). September 4th, 1928. (322,010.)

25,473. "Systems for regulating the speed of asynchronous motors." British Thomson-Houston Co., Ltd. (Compagnie Française pour l'Exploitation des Procédés Thomson-Houston). September 5th, 1928. (322,011.)

25,768. "Electrical relays." H. V. Higgitt and Eastern Telegraph Co., Ltd. September 7th, 1928. (322,015.)

26,067. "Apparatus for reproducing mechanical movements by electrical means." M Paul and Dr. P. Wangemann. December 3rd, 1927. (301,724.)

26,077. "Shock-absorbers for use with electric lamps." A. J. Thompson. September 11th, 1928. (233,018.)

26,291. "Electric circuit-breakers." British Thomson-Houston Co., Ltd., and H. C. Heath. September 13th, 1928. (322,019.)

26,399. "Cascade-connected electrical groups." Ateliers de Constructions Electriques de Charleroi. May 12th, 1928. (312,032.)

26,586. "Systems for the electrical transmission of photographs and the like and for television." Graham Amplion, Ltd., and W. J. Rickets. September 17th, 1928. (322,025.)

26,757. "Micro-telephones." Telefonaktiebolaget L.M. Ericsson. September 20th, 1927. (297,390.)

26,999. "Means for cooling of dynamo-electric machines." International General Electric Co., Inc. September 23rd, 1927. (297,467.)

27,170. "Recording and reproduction of sound." S. G. Brown. September 21st, 1928. (322,033.)

27,893. "Multiplex type-printing telegraphs." Western Union Telegraph Co. August 18th, 1928. (317,458.)

28,189. "Electrical resistances." Naamlooze Vennootschap Machinerieen en Apparaten Fabrieken. October 7th, 1927. (298,231.)

28,644. "Electric relays." International General Electric Co., Inc. October 6th, 1927. (298,239.)

29,519. "Galvanic batteries and the like." G. Redmayne. October 13th, 1928. (322,048.)

29,873. "Fire-alarm systems, in conjunction with telephone-exchange systems." Relay Automatic Telephone Co., Ltd., and T. M. Inman. October 16th, 1928. (Addition to 321,303.) (322,050.)

30,627. "Tanks wherein water is heated electrically." Santon, Ltd., and H. C. Sanders. October 23rd, 1928. (Cognate applications 33,835/28 and 38,141/28.) (322,055.)

31,181. "Directive transmission or reception of sound or other wave energy." Electroacustic Ges. October 27th, 1927. (299,475.)

31,311. "Automatic vehicle-controlled track-signalling devices." G. S. Oliver. October 29th, 1928. (322,063.)

31,374. "Obtaining smooth and dense electrolytic metallic deposits." Metallges. Akt. Ges. October 27th, 1927. (299,725.)

32,413. "Protective devices for electrical apparatus." Associated Electrical Industries, Ltd. November 16th, 1927. (300,276.)

33,564. "Control switches for vehicle direction-indicators." V. A. Trier. November 16th, 1928. (322,079.)

33,672. "Circuits embodying iron-cored transformers." Gramophone Co., Ltd., and C. O. Browne. November 16th, 1928. (322,081.)

33,781. "Diaphragms for loud-speakers and the like." P. Bischoff. November 17th, 1928. (322,083.)

34,280. "Brush-holders for dynamo-electric machines." Soc. Anon. des Etablissements Ducellier. January 28th, 1928. (305,015.)

34,770. "Connections for electric resistances." Soc. Anon. Le Carbone. January 20th, 1928. (304,304.)

35,068. "Coupling-up of isolating switchgear." G. E. Whitehead. November 28th, 1928. (Addition to 286,429.) (322,094.)

35,089. "Electric circuit-interrupters." H. K. Ramsden and Associated Electrical Industries, Ltd. November 28th, 1928. (322,095.)

35,095. "Direction-indicating device for road vehicles." L. L. Fibbens and W. H. Gleadhill. November 28th, 1928. (322,096.)

35,303. "Control systems for elevators, hoists, and the like." Associated Electrical Industries, Ltd. November 30th, 1927. (301,473.)

35,763. "Electric transformers." British Thomson-Houston Co., Ltd., and J. C. Read. December 4th, 1928. (322,107.)

35,915. "Electric motor field control." Marion Steam Shovel Co. August 31st, 1928. (318,216.)

36,213/4. "Apparatus for influencing substances by means of high-frequency electric energy." Dr. A. Esau and C. Lorenz Akt. Ges. December 8th, 1927. (301,029/30.)

36,564. "Wheatstone-bridge filter for suppressing disturbances in thermionic-valve current-supply circuits." Hazeltine Corporation. January 20th, 1928. (304,309.)

36,866. "Photo-electric cells." British Thomson-Houston Co., Ltd. January 4th, 1928. (303,476.)

38,212. "Electrothermal release device for electric switches." Schiele and Bruchsaler Industriewerke Akt. Ges. December 28th, 1927. (303,118.)

1929.

1,019. "Reflector for illuminating devices." R. Weinert. January 11th, 1929. (322,125.)

1,106. "System of electric signalling for automatically insuring safety in railroad traffic." A. Iasquin and R. (*née* Foy) Delfosse. January 11th, 1928. (Patent of addition not granted.) (303,872.)

2,221. "Lantern or lamp for use on trains and vehicles." General Electric Co., Ltd., and E. L. Randall. January 22nd, 1929. (322,129.)

2,514. "Control systems for electric motors." G. Somajni. January 31st, 1928. (305,135.)

2,952. "Electrically-driven hair-cutting machines." R. Bosch Akt. Ges. February 14th, 1928. (306,928.)

3,218. "Time switch." Landis et Gyr Soc. Anon. March 1st, 1928. (307,014.)

6,884. "Apparatus for the electro-osmotic separation from solutions of anodic or cathodic travelling particles." Siemens-Elektro-Osmose Ges. March 15th, 1928 (307,879.)

7,531. "Processes for the manufacture of membranes for electrostatic loud-speakers." E. Reisz. March 13th, 1928. (307,794.)

8,447. "Transmitters for telephone systems and the like." Siemens Bros. and Co., Ltd., and G. F. Dutton. August 24th, 1928. (Divided application on 308,630.) (321,994.)

12,037. "Electric discharge lamps for television receivers." J. L. Baird and Television, Ltd. June 20th 1928. (Divided application on 319,304.) ((321,930.)

12,038. "Television apparatus and the like." J. L. Baird and Television, Ltd. June 20th, 1928. (Divided application on 319,304.) (321,961.)

15,527. "Electric lamps." General Electric Co., Ltd. May 23rd, 1928. (312,273.)

25,766. "Protective arrangements for electric power lines or the like." R. O. Kapp and C. G. Carrothers. November 9th, 1928. (Divided application on 317,875.) (322,156.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from December 11th:—

Dyalmo. No. 505,352. Class 6. Electric lighting, power and ignition machines and parts thereof for motor vehicles and motor cycles.—M.L. Magneto Syndicate, Ltd., West Orchard, Coventry.

Solar. No. 502,340. Class 8. Radio-telephonic apparatus, &c.—British Homophone Co., Ltd., 67-69, City Road, E.C.1.

S.P., Siemens-Planiawerke (lettering and design). No. 504,861. All goods in Class 8.—Siemens-Planiawerke Gesellschaft, Berlin. (British representatives: Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, W.C.2.)

Pentector. No. 507,888. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—Lissen, Ltd., Richmond, Surrey.

Shield (design only). Nos. 505,350 and 505,526. Instruments and apparatus for use in telegraphy, telephony, radio-telegraphy and telephony, instruments and apparatus for recording, reproducing and amplifying sound, electrical resistances, electric light transformers, and electric lamps for scientific purposes. No. 505,529. Class 13. Electric lamps and electric light fittings. No. 505,530. Class 15. Glass. No. 505,531. Class 18. Engineering, contrivances and lighting instruments. Phililux. No. 505,343. Class 13. Electric lamps and electric light fittings. No. 505,344. Glass. Philiray. No. 505,345. Class 13. Electric lamps and electric light fittings. No. 505,530. Class 15. Glass. Argaphoto. No. 505,347. Class 13. Electric lamps and electric light fittings. Photomirepta. No. 505,349. Class 13. Electric lamps and electric light fittings. Philuma. No 505,340. Class 15. Glass. Phillilite. No. 505,342. Class 15. Glass. Conex (lettering and design). No. 501,774. Class 16. Insulated connectors made chiefly of porcelain for making joints in electric cables and in the like electric conductors. No. 504,053. Class 50. Ditto made chiefly from condensation products of phenol-formaldehyde. —Philips Glowlampworks, Eindhoven, Holland. (British representatives: Boult, Wade and Tennant, 112, Hatton Garden, E.C.1.)

Kappit. No. 507,455. Class 8. Electric cables.—Callender's Cable and Construction Co., Ltd., Hamilton House, Victoria Embankment, E.C.4.

Strombo. No. 507,040. Class 13. Connecting switches for electric lamps and the like.—A. E. Howard, 5, High Holborn, W.C.1.

Aeolus. No. 507,373. Class 18. Engineering, architectural and building contrivances.—Electric Central Heating and Ventilating Co., Ltd., 157, West George Street, Glasgow.

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New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ASHINGTON.—Institute, baths and library; surveyor to U.D.C.

BANSTEAD.—Admission hospital at mental institution (£57,000); L.C.C. architect.

BILLINGHAM.—Pumping station, Port Clarence, for the U.D.C.; J. H. Hill, engineer, Haverton Hill-on-Tees.

BLACKPOOL.—Theatre, Abingdon Street, for G. B. Catlow. Cinema, Westcliffe Drive, for F. Barker.

BRADFORD.—Tenements (78), White Abbey area; city architect.

BRIGHTON.—Houses (56), Whitehawk estate; borough engineer. Shops (7), Hollingbury Place; James Morley. Elementary school, Lewes Road (£29,000) for the E.C. Operating department, Royal Sussex County Hospital; governors. Additions to Throat & Ear Hospital, Church Street; governors.

BRISTOL.—Houses (48), Horfield estate (£18,480); J. P. Ogsley & Son.

BROMLEY (KENT).—Extensions, Bromley and Chislehurst Maternity Home; P. A. Coad, architect, 90, Nightingale Lane.

BUCKINGHAM.—Senior school, for Bucks. E.C.; director of education, Aylesbury.

BURTON-ON-TRENT.—Houses (34), Gordon Street; borough engineer.

CHEADLE (STAFFS.).—School for Staffs. E.C.; education architect, Stafford.

CHELSHAM.—Extensions to mental hospital; Croydon Corporation.

CHERTSEY.—Conversion of Botley Park Mansion, Ottershaw, to home for mentally defectives, for Surrey C.C.; clerk, Kingston-on-Thames.

CHESTERFIELD.—Extensions to municipal offices; Corporation sub-committee. Machine shop, Sheepbridge Works; Sheepbridge Stoke Casting Co., Ltd.

COLCHESTER.—School, Harwich Road, for the City E.C.; director of education.

CREWE.—Men's hostel (£18,755), for Cheshire E.C.; county architect, Newgate Street, Chester.

DARTFORD.—Re-housing scheme, Howard Road; U.D.C. surveyor.

DENNY.—Housing scheme (24), with electrical work, for the T.C.; James Strang & Wilson, architects, Falkirk.

DERBY.—Municipal aerodrome; borough engineer.

DEWSBURY.—Employment exchange, Wellington Street, for H.M. Office of Works, King Charles Street, London, S.W.

DONCASTER.—R.C. church at Denaby Mill; Holton & Fox, architects, Corporation Street.

DUDLEY.—Technical college (£77,500), for the governors; clerk.

EAST MOLESEY.—Talking film studio (£350,000); Col. W. M. Power, Windsor House, Victoria Street, S.W.

ECCLES (LANCS.).—Fire station and quarters for the T.C.; borough surveyor. Business stores, Regent Street, for the Co-operative Society; secretary. Bank, for the Manchester & Salford Trustee Savings Bank; secretary.

EDENBRIDGE.—Memorial hospital; Read & Macdonald, architects, 16, Cork Street, London, W.

FOLKESTONE.—Business premises, Sandgate Road, for Bobby & Co., Ltd. Shops (16), and houses (13), for D. Pope, builder.

FULWOOD (NEAR PRESTON).—Extension of St. Cuthbert's Schools; Rev. A. Douglas, vicar.

GARSTON (WATFORD).—School (412 places), for Herts. E.C.; A. E. Prescott, county architect, Hatfield (returnable deposit of £1 1s.).

GATESHEAD.—Girls' Secondary School; director of education. School, Dunston (£20,000); Rev. L. Pickering, rector, St. Philips R.C. Church.

GLASGOW.—Houses, Auldhouse Road and Holeburn Road; Alexander McLellan, Ltd., 22, King Street, Pollokshaws. Re-housing scheme in connection with Finneston bridge; housing director. Isolation hospital; Corporation Health Committee.

GODALMING.—Houses (44), for the T.C.; Enticknap Bros., builders, Wormley

HAMPTON.—Development, Rectory Farm estate; Hampton Grammar School Foundation.

HETTON-LE-HOLE.—Housing scheme (50), for the U.D.C.; Mr. Fennell, architect.

HITCHIN.—Housing scheme (100), for the R.D.C.; surveyor.

IRISH FREE STATE (DUBLIN).—Conversion of Charlemont House, Rutland Square, to art gallery (£35,000); city commissioners.

KINGSWINFORD.—Housing scheme (42), Portway, for the R.D.C.; W. Meredith, surveyor.

LEEK.—Senior school, for Staffs. E.C.; director of education, Stafford.

LEYLAND.—Cinema, central site; surveyor to U.D.C.

LINCOLN.—Houses (16) with electrical work on Wragby Road estate, for the City Council.

LONDON (EAST HAM, E.).—Factory, Church Road; T. Anders.
(HACKNEY, E.).—Flats (50), Homerton Row; borough engineer. Factory, Knightsland Road; Burnett & Eprile.
(BRIXTON, S.W.).—Church and school, Acre Lane; Davidson, Son & Sherwood.
(SMITHFIELD, E.C.).—Offices, Central Market, Charterhouse Street (£15,000); city engineer.
(LAMBETH, S.E.).—Tenements, China Walk (£19,806); A. T. Rowley, Tottenham.

MAIDENHEAD.—New block at Isolation Hospital, for the B.C.; Lt.-Col. P. Johns, engineer, Guildhall, Maidenhead (returnable deposit of £3 3s.).

MANSFIELD.—Housing scheme (108), for the T.C.; borough surveyor.

MIDDLESBROUGH.—Houses (100), for the T.C.; Gilbert Long, Ltd., builders.

NEWARK.—Houses (56), for the T.C.; W. Smith (Newark), Ltd., Millgate.

NEWCASTLE-ON-TYNE.—Municipal aerodrome; city architect.

NEWPORT (I.O.W.).—Additions to ice factory, Coppins Bridge, for Isle of Wight Ice Co., Ltd.; Stratton and Millgate, architects.

OLDHAM.—Re-erection of portion of engineering works, Havelock Street, electrically equipped, for W. Gunther and Sons.

PORTSMOUTH.—Houses (58), North Prospect; A. Snape. Secondary school, North End (£104,419); S. Salter. 'Bus depôt, Eastney (£16,194); J. Main & Co.

PURLEY.—Houses (115), Old Lodge estate; Old Lodge Estates, Ltd.

RIPON.—Additional 44 houses for the T.C.; borough surveyor.

ROMFORD.—Factory, King Street; Mr. Cousins.

SKEGNESS.—Houses (45), Grosvenor Road, for the T.C.

SLOUGH.—Houses (2,000) and shops on Baylis Court estate; P. Ellis & Co.

SOUTHEND-ON-SEA.—Rebuilding Middleton Hotel and The Royal Stores, for Mann, Crossman & Paulin, Ltd.; William Stewart, architect, Aldgate, London. Rebuilding London Hotel; A. R. Mayston, architect, Chiswell Street, E.C.

STOCKPORT.—Houses (118), for the T.C; Thomas Davies and Son, builders.

TEDDINGTON.—New St. Mark's Church (£18,000); incumbent.

TWICKENHAM.—Houses (800), Redway Estate; Simmons and Grellier, architects. Houses (118), Alton Gardens Estate; A. Pascall and Sons, Ltd.

WALLINGTON.—Boys' secondary school, for Surrey E.C.; W. W. Finny, secretary, Kingston-on-Thames. Houses (41), Headley Avenue, for T. Markwick & Co.

WARRINGTON.—Housing scheme (162), for the T.C.; A. M. Ker, borough engineer (returnable deposit of £2 2s.). Housing scheme (50), Grappenhall, for the R.D.C.; J. L. Beckett, surveyor. Bakery, for the Co-operative Society; C.W.S. architect, Balloon Street, Manchester (returnable deposit of £1 1s.).

WATFORD.—Additional housing scheme (600), for the T.C.; borough surveyor.

WELLS (SOMERSET).—Extensions, District Hospital, with X-ray department and operating theatre; secretary.

YORK.—Extensions, newspaper works, for the Yorkshire Herald Newspaper Co., Ltd.; Blackmore, Sykes & Co., architects, Ruskin Chambers, Scale Lane, Hull.

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The ELECTRICAL REVIEW

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See p. liii.

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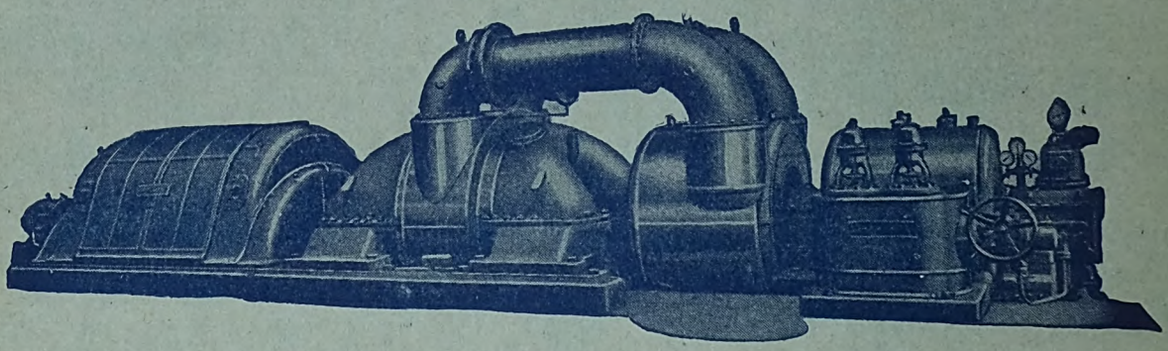

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The
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Low-temperature Heating.

ALTHOUGH the more obvious uses of electricity have already been exploited in some degree, it is evident that we have as yet touched only the fringe of the possibilties of the conversion of electricity into heat as applied to industry, residences, and commercial buildings.

The two papers read before the I.E.E. last week had a common subject in so far as they related to the use of electricity at the relatively low temperature of 120 deg. F. or less. The authors, we think, quite easily made the point that the destruction of some four pounds of coal, at the very least, in order to obtain the heat equivalent of one pound, is justifiable in many instances by the nett advantages obtained. These advantages were shown to be cleanliness, ease of control, reduction in labour, and saving of space, which all possess economic value; to these the absence of combustion products in commercial and residential areas adds an important social value.

The paper by Lieut.-Col. S. E. Monkhouse and Mr. L. C. Grant gave particulars of several examples of the successful application of panel heating to large buildings, the most notable being Carliol House, the headquarters of the Newcastle-upon-Tyne Electric Supply Company, and Railway House, Broadway, Westminster, the new offices of the London Underground Railways. The heating installation at the latter building was fully described in our issue of September 20th.

In all these cases advantage has been taken of the principle of storage in the easiest and cheapest form in which electricity can be stored, *viz.*, the heating of water, by which means also the load factor of the system has been improved.

Mr. T. G. N. Haldane, on the other hand, calls in latent heat to redress the heat balance of the power station. He claims efficiencies of upwards of 300 per cent. for his heat pump, which is in essence a reversed-cycle refrigerating plant. Although such efficiencies, as the author points out, are not true thermodynamic efficiencies, they do represent the practical results of the process.

The connection of the heat-pump with electricity is that it would obviously be driven by an electric motor. The

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motor would, however, have to run continuously, save for an hour or so over the highest peak of the load, but at the same time owing to the high efficiency, as defined by the author, the actual cost per 3,410 B.th.u. would be appreciably less than that obtainable by thermal storage. The principles set out in the paper have been checked by actual experience in the operation of such a plant for domestic heating. Another use for the heat pump is suggested by the fact that the highest efficiency is obtainable when the difference in temperature between the cooling media is least; thus its use for warming the water of public baths appears eminently practical, and we understand that developments are pending in this direction.

Valuable as these papers are for the information they give on a subject of first-class importance, it seems to us that perhaps the greatest service the authors have done to the industry is to provide examples of faith expressing itself in works. On the one hand, an electricity supply undertaking heats its offices electrically by what is believed to be the largest installation of its kind in the world; on the other, an electrical engineer uses the method he advocates in his own home.

Trade with India.

IN Indian commercial circles, says Mr. T. M. Ainscough, H.M. Senior British Trade Commissioner in that great Dependency, there is very little sentiment in business—price is the controlling factor. He told the members of the Royal Empire Society at a luncheon held in London last week that our proportion of India's import trade was now considerably lower than it was in pre-war days (45 per cent. now as compared with 63 per cent.) for various reasons, one of which was a temporarily reduced demand for textile machinery, railway stores, and other British specialities, while another was the non-adjustment of the market to the post-war level of prices, especially for British high-grade productions.

The menace of foreign competition was present in all trades. Increased business was being done by Germany, the United States, Japan and other countries, and the Indian Government, while determined to buy in the cheapest market, was showing a preference to Indian-made goods. Mr. Ainscough reiterated the standard advice to the British manufacturer about taking personal interest in the market, recognising that the question of distribution of goods was a problem to be seriously faced; he emphasised the need for technical knowledge in the marketing of machinery and the need for appreciating that to hold or capture the Indian market, large expenditure and much trouble were inevitable.

The pending introduction of a new purchasing system by the Government of India will make matters even more difficult for British exporters. Some details of the scheme are mentioned in the "Business Notes" section of this issue. From these it will be seen that apart from special requirements, which may be dealt with by the India Store Department in London, British manufacturers will be on more equal terms with their foreign competitors. The rules do not appear to consider preference for British goods merely on account of their origin. Indian or semi-Indian goods are the first choice, the criterion apparently being quality, not price; next in order come goods held in stock in India. It is thus becoming essential for British manufacturers to strengthen their position in India even to the extent of forming Indian companies with rupee capital, as advised by Mr. Ainscough in his last published annual report, which was reviewed in our issue of December 28th, 1928. Readers interested in the subject may find it worth while to refer back to this review (or to the report itself).

Accidents due to Electricity in Mines.

IN the annual report for 1928 of H.M. electrical inspector of mines, our customary summary of which is started in this issue, an analysis is made of the accidents in mines due to the use of electricity. There were 15 fatalities in 1928 coming under the two heads of shock (11) and firedamp explosion (4), the highest figure since 1924. The average annual number of fatal accidents has, however, decreased during the last 11 years by 35 per cent. of the average for the previous 11 years, whereas the h.p. of motors installed has increased by about 70 per cent. Accidents in 1928 had their origin, as in other years, in disregard of regulations, ineffective supervision, inadequate maintenance, and carelessness on the part of operatives.

It is pointed out that before working on live conductors it is a legal requirement that the conductor shall be earthed. A common failing is illustrated by one accident in which the safety and reliability of an enclosed switchboard was discounted by subsequent additions entirely out of keeping with the standard of the original equipment. Nearly half of the non-fatal accidents were in connection with the use of trailing cables and plugs, and attention is drawn to the desirability of using a plug made in accordance with the requirements of the British Standard Specification. This specification ensures interchangeability as well as flame-proof enclosure; in addition, it provides for a mechanical interlock with the switchgear and, if desired, for an electrical interlock also.

Cookers and Cooking.

WHILE we do not necessarily associate ourselves with all the views expressed by "A Consumers' Engineer" in our "Electricity For The Home" section of this issue, we do most heartily welcome his article, first, as being likely to help all interested in the development of domestic electricity supply, and, secondly, as a warning to manufacturers of electric cooking apparatus against the possibility of their being enticed by present commercial successes into believing that the last word has been said on electric cooker design.

Our contributor asserts that cookers are being put into service to-day which in a short space of time will disappoint their present buyers. If such proves to be the case very much harm indeed will be done to the supply industry in its work of domestic electrification. The "electric idea" is beginning to capture the consideration of the public, and it would be suicidal at this stage to take unfair advantage of the consumer's willingness to try by serving him with apparatus that would not stand the test of time. We repeat what we have asserted time and again, that the electric cooker is now a thoroughly reliable and efficient apparatus, but any tendency to put on the market "shoddy" apparatus for the sake of cheapness should be vigorously discouraged.

That the primary function of the cooker is to cook, and not necessarily to be a piece of apparatus with the highest possible thermal characteristics, is a reminder that may prove more useful to the supply engineer than to the manufacturer; supply engineers are inherently advocates of thermal efficiency.

Perhaps the most interesting points in the article in question are the suggestions that the ultimately accepted boiling plate will be of the open type, and that the correct future method of design for the boiling plate will be to increase the area of application of the load, and not the intensity. The marked reduction in maintenance costs which has followed the introduction of the closed boiling plate has had the effect that supply engineers now "swear by" the closed plate, while manufacturers have repeatedly assured us that the ideal boiling plate will not be obtained until it is possible to concentrate a much higher loading in the area necessarily restricted by the size of the hob.

1930.

WITH this issue we complete another year's "Review" of electrical affairs. Week by week we have endeavoured to place before our readers a faithful record of outstanding developments, and to provide for them a feast of good things to assist them in adding to their professional knowledge and in conducting industry and trade more efficiently. Without looking backward into detail, we may say that on the whole there has been gratifying electrical progress and advance, and believing that the pace will be quickened in 1930, we wish all readers of these lines "A Happy and Prosperous New Year."

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The Radiological Exhibition.

Finality in design is far from being attained; apparatus is, with some exceptions, being built increasingly on engineering lines; electrical safety is also a noticeable feature.

By E. H. W. BANNER, M.Sc., A.M.I.E.E., A.Inst.P.

THE exhibition of X-ray apparatus held at the Central Hall, Westminster, on December 4th, 5th, and 6th, has now become an annual fixture and an integral part of the annual meeting* of the British Institute of Radiology incorporated with the Röntgen Society. This year it was referred to by Mr. C. Thurstan Holland, president of the Institute, as the best British exhibition held, and much that is new was exhibited. To a prospective purchaser of X-ray apparatus such an exhibition is of the greatest value, as it enables all British makes and some foreign ones to be compared side by side. Further, there is more tendency on the part of the least progressive of the firms to increase and improve their standard, as out-of-date apparatus shows up badly in comparison with modern gear. The apparatus shown was practically entirely confined to medical purposes, as was to be expected, which fact might have conveyed the erroneous idea to engineers visiting the exhibition that other purposes for which X-rays are used are negligible. Actually this is far from being the case, as industrial applications are continually increasing, and also to physicists X-rays form an unparalleled weapon in the examination of the structure of matter.

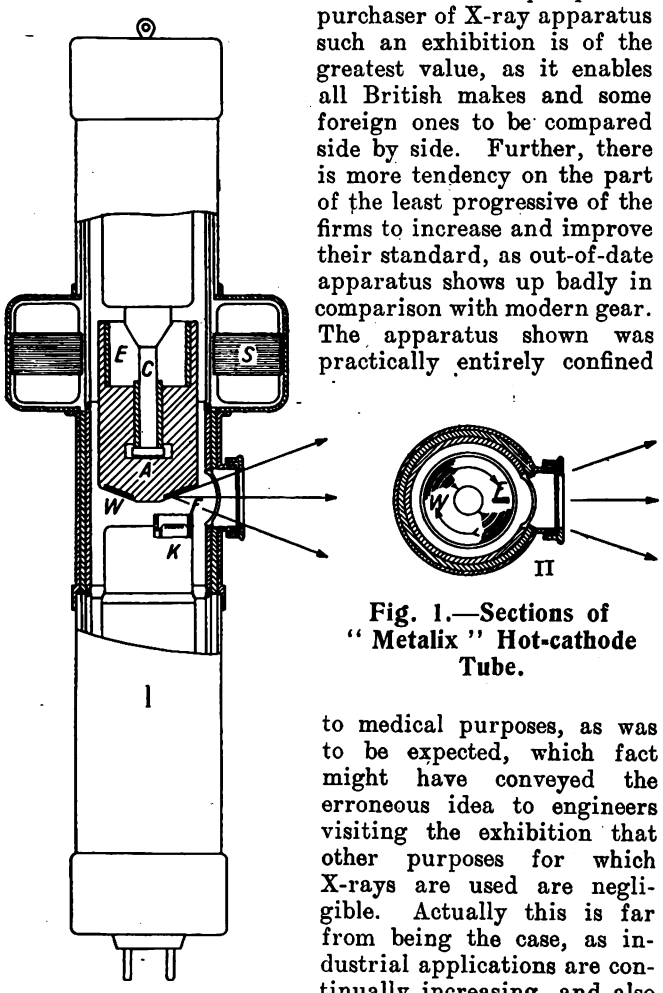

Fig. 1.—Sections of "Metalix" Hot-cathode Tube.

Modern X-ray generators now consist almost exclusively of the following: a high-voltage transformer, stepping up to about 100 kilovolts; a rectifier, either a thermionic valve or a mechanical commutator; and an X-ray tube of the thermionic or hot-cathode type. In some of the relatively small outfits the rectifier is dispensed with, as the X-ray tube is self-rectifying under certain conditions. In the early days of radiography, thirty odd years ago, induction coils and direct current were usual, while thermionic rectifiers and X-ray tubes were unknown, the tube being of the "gas" variety, which corresponded then to a good vacuum. Such tubes are still used to some extent, owing to their relative cheapness, and many hundreds were used during the 1914-18 war in hospitals at home and abroad.

The most important improvements in each of the above main items are as follows:—

Transformers.—These are definitely an engineer's job, and in general only small points of difference over earlier types are noticeable. Outputs tend to increase somewhat, and the main problem is to design a secondary winding for a high voltage in a small space, this limit being in evidence far more than the thermal one of keeping down the temperature rise.

A year ago a B.E.S.A. specification was issued for transformers for X-ray purposes, and there has already commenced a measure of standardisation of sizes, ratings, &c., although as most customers are medical men and unfamiliar with B.E.S.A. specifications it will be somewhat slow in becoming general. A number of manufacturers definitely make their transformers to the specification, and such practice can only be commended, as direct comparison is possible by means of the standard ratings, as engineers will agree.

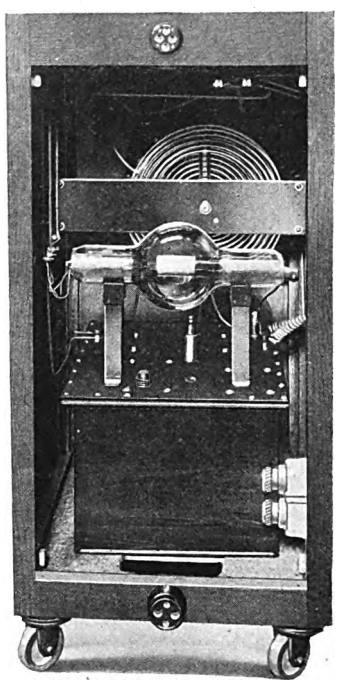

Fig. 2.—Valve Diathermy Set.

Rectifiers.—No marked alteration has been evident in the last few years. Most manufacturers supply sets with thermionic rectifiers and with mechanical rectifiers, the former being mostly in demand. The advantages of the thermionic valve type are absence of noise, smaller bulk, and no moving parts, whilst the mechanical rectifier has the advantage of greater robustness, indefinite life, and the possibility of passing only the peaks of the wave, so eliminating the useless lower voltages from the resulting unidirectional output. Valve rectifier sets require either one, two, or four valves for a single-phase supply, one valve providing half-wave rectification—with the exception of a special circuit which also utilises a condenser

* See ELEC. REV., December 6th, 1929, p. 1005.

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and so obtains full-wave rectification—and two or four valves rectifying the whole wave. For three-phase circuits an arrangement of six valves gives a very smooth output without recourse to condensers.

An X-ray tube is itself a rectifier, provided that its anode is at a low temperature relatively to the cathode or filament, so that for small outfits intermittently worked no rectifier is necessary, and several sets are available

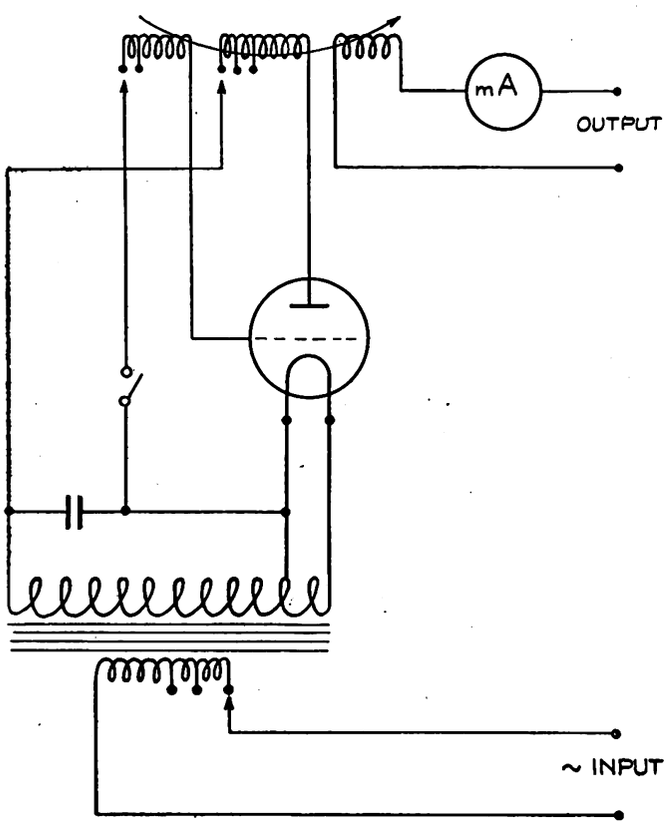

Fig. 3.—Circuit of Valve Diathermy Set.

having this advantage, which is particularly noticeable in portable and dental sets. The increased use of valve rectifiers over mechanical ones may seem at first sight to be a departure from engineering plant, but, when it is realised that increasing numbers of mercury-arc rectifiers are satisfactorily used in modern sub-stations, it will be admitted that it is not departing from present-day engineering practice.

X-ray Tubes.—The only marked advance on previous tubes is the new Philips tube with a rotating anode. A small area of the anode is actually used during an exposure, and, as the temperature of this limits the loading, it is obvious that a rotating anode will expose a greater area of the anode to the bombardment from the filament, whilst retaining the small focal spot or working area necessary for good definition of the radiograph.

The Coolidge tube, the original thermionic tube, is now used to a less extent in this country on account of the main advantage of the " Metalix," a Philips tube, which embodies its own X-ray protection and is therefore smaller when installed. In addition, its line focus, as distinct from the point focus, is claimed to give better results. The Muller tube is also a line focus tube, the residual gas being helium.

General.—The rest of the apparatus is chiefly of medical interest, and includes some form of couch with the tube above or below, and a vertical screening stand in which a patient may stand or sit; the progress of an opaque meal may be watched on the screen and radiographed as required, or the lungs may be examined.

Old sets had a large lead-rubber lined tube-box and exposed high-voltage leads. The " Metalix " tube, being self-protected, needs no material opaque to the rays to house it, and in some sets the high-voltage leads are of the condenser type of flexible cable, so that no live conductor is within reach. When such gear as is mentioned above was used with an induction coil it was rare that more than an unpleasant shock was obtained by contact with the live conductors, but modern installations with large power transformers on supply mains are capable of dealing fatal shocks, and so require much more care in installation. Last year installations were described and shown in which the power unit was in a separate sub-station and the leads run quite out of reach of the operator and patient. Such a tendency is certainly good and in very large installations is becoming universal.

A few years ago an American firm showed a dental outfit in which the transformer and tube were contained in an earthed metal box, which was brought near the patient. This feature has now been extended to a larger set in which no high-voltage gear can possibly be touched. In addition, no X-rays emerge except through a glass window directed on to the part required. This set may prove to be the forerunner of a large number of installations of this type, both for small sets and for large hospitals, where each tube is part of a compact and independent unit.

New Apparatus Exhibited.

Although diathermy apparatus is by no means X-ray gear, it is mentioned here partly because a number of manufacturers exhibited such apparatus, but chiefly because the diathermy set, fig. 2, of Messrs. Phillip Creswick utilises a thermionic valve to generate its high-frequency oscillations, somewhat similar to a wireless transmitter and unlike other sets which use a spark generator. This set embodies a self-cooled valve having a dissipation of 500 watts, its working frequency being of the order of a million and a half cycles per second. Currents up to 1.5 amperes may be passed through a patient, the peculiarity of this high-frequency current being that no shock is felt, but a slow sensation of local warmth. Control is by means of a switch in the grid circuit, and its filament is excited from a tapping on the transformer secondary, fig. 3. The grid and anode coils, which are spirals, are both capable of variation by tappings directly on the coil.

A new set intended for deep therapy, by providing a current of 8 mA continuously at 180 kV peak, was exhibited by Messrs. A. E. Dean in their " Cheltenham " set, fig. 4. In this apparatus two condensers are used

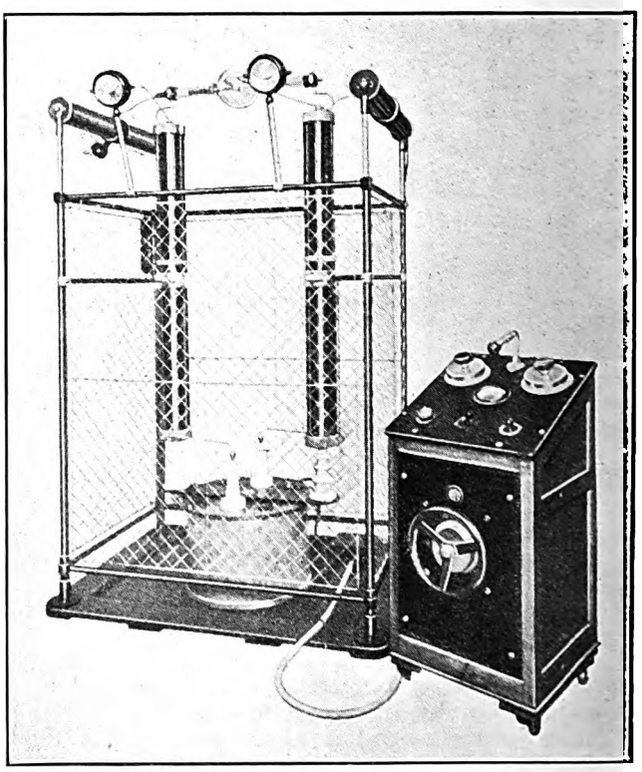

Fig. 4.—Therapy Set, One Valve, Two Condensers.

and a single rectifier. The transformer voltage is doubled by this means and a compact set encased in wire mesh results.

The " Simplex " unit is a transportable set containing its transformer in the mobile control table. The tube stand is also fixed to this so that the whole may be readily moved on its wheels. Its rated output is 30 mA at 90 kilovolts peak. The " Radiostat " unit is a larger plant with the generating equipment—transformer and mechanical rectifier driven by a synchronous motor—mounted in a wooden cabinet, on top of which is a point-

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point spark gap, as used in the old days with induction coil sets, and a milliammeter showing current through the X-ray tube. This has a rated output of 100 mA. A four-valve set was also shown, the valves being mounted vertically above the transformer, the whole being again in a wooden case with a point-point spark gap and instruments on the top. A useful feature of the valve sets of this firm is a filament stabiliser, by means of which the

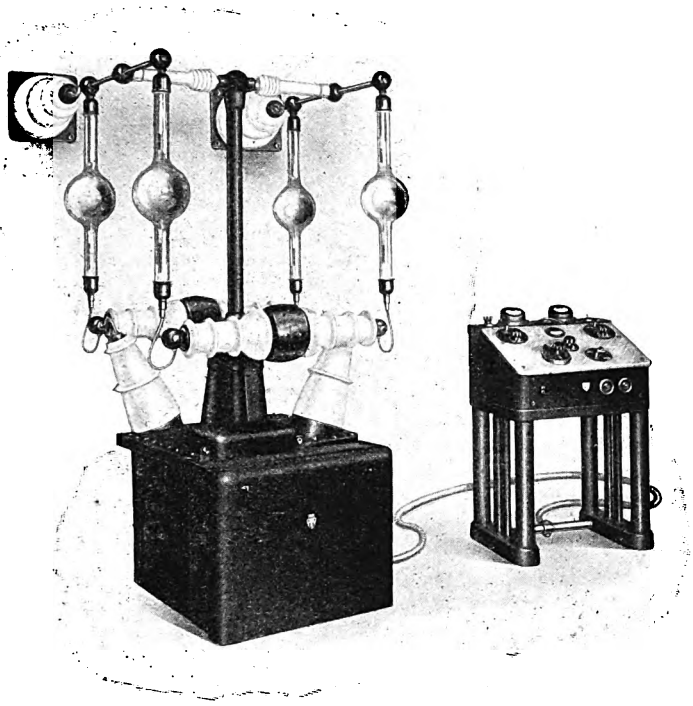

Fig. 5.—A 4-Valve G.R.S.A. Outfit.

rectifier filament current is maintained at its correct value during an exposure.

There is a tendency towards eliminating wood cases and using metal construction, as in the " Cheltenham " set, although this is at present not complete. Instruments used in high-voltage circuits are screened electrostatically, so that the pointers do not pick up stray charges and cause spurious readings, as it is not always possible to place the instruments in an earthed lead. A vertical screening stand for two metres distance was also shown.

The General Radiological and Surgical Apparatus Co. supplies almost all Germany and a number of other countries on the Continent, and thus has a very large market. The chief new feature, from an engineering standpoint, of the company's outfits is the abolition of the auto-transformer generally used with the primary of the main transformer, the tapping being directly on the primary winding. For large sets relay control from the mobile control cabinet is included, and the absence of the auto-transformer is coupled with the absence of rheostats from the filament transformer controls, tapping being directly on the bared primary winding by a sliding switch. Much more uniform variation of voltage by these means is claimed. A large three-phase set has close voltage regulation, resulting in the drop in voltage on load being only 1.5 kV per 100 mA of tube current, and the general feature of independent controls for screening and radiography are also incorporated. Another unit was the " Mobile Heliodor," the whole of which apparatus is mounted on a stand capable of being wheeled about. Its maximum voltage is 93 kV, and its rating 30 mA at 85 kV, and 40 mA at 65 kV. The " Power Heliodor " is a heavier apparatus, contained in a metal case and delivering 150 mA at 100 kV. A four-valve set has its rectifying valves mounted directly on the transformer, the whole being enclosed, fig. 5.

As an example of six-foot radiography a screening stand called the " Tele-orthoscope " was shown. This provides for a longitudinal movement of the tube away from the patient, together with tilting and swinging movements, so that oblique screening or radiography may be carried out. The whole moving system is balanced by adjustable springs instead of counterweights, in order to make the set readily responsive to the touch, an aid to rapid diagnosis. This firm also showed a dosimeter for measuring the amount of radiation actually received by a patient undergoing X-ray therapy.

British-made thermionic rectifiers are incorporated in the valve sets of Messrs. Newton and Wright (the only other British-made valves being those made by the Osram Valve Co.) who have recently equipped a large installation at the Ruchill Fever Hospital, Glasgow. A four-valve set of the conventional type, fig. 6, was a part of their exhibit, and although mechanically-rectified plants were not on view the demand for them approaches that for valve sets. The single-valve set is in greatest demand, a feature which is fairly general.

A novel exhibit was a vertical stand arranged especially for stereoscopic radiography. Two X-ray tubes are arranged side by side with their rays facing the patient and the film, and separated from each other by a short distance; both tubes are connected to the high-voltage supply, but the filaments are in series with a switch which short circuits either at will. An exposure is made with one tube; the film is then moved and a fresh one brought into the field, whilst the switch is being changed over to energise the other tube, it being realised that only the tube with the hot filament will emit X-rays, and, as the two have different view points, the films, when viewed in a stereoscope, give a very good binocular image.

Overhead high-voltage gear includes a special selector switch, by means of which an outfit may be switched to

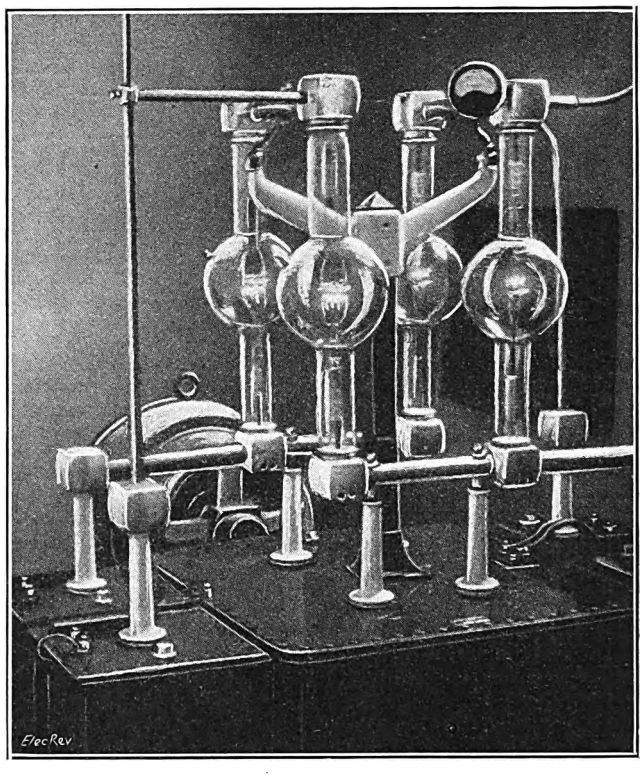

Fig. 6.—A 4-Valve " Tetravalve " Set.

a screening stand, a tube above a couch, or another one below. Each position is obtained by pulling a cord marked suitably, so that no mistake is possible.

The " Metalix " tube is probably the most important item of Messrs. Philips Lamps, Ltd., for X-ray work, and new tubes include those for powers of 2½, 6, and 10 kW. Generally speaking, the penetration and quantity of X-rays is limited by the X-ray tube, although for medical purposes these limits are high enough with present technique. The only outstanding progress is the design of a rotating-anode tube of the " Metalix " type, particulars of which will be detailed later, as a paper was read on this tube at the meeting. An illustration of this firm's hot-cathode tube is given in fig. 1. The latest X-ray device of this firm is the dental set, fig. 7, which

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provides an alternative: for wall and for floor mounting. Each is somewhat on the lines of the "Metalix" portable shown last year, the transformer being small and compact and connected to the self-rectifying tube by condenser leads having their flexible metal sheaths earthed, so that complete electrical as well as

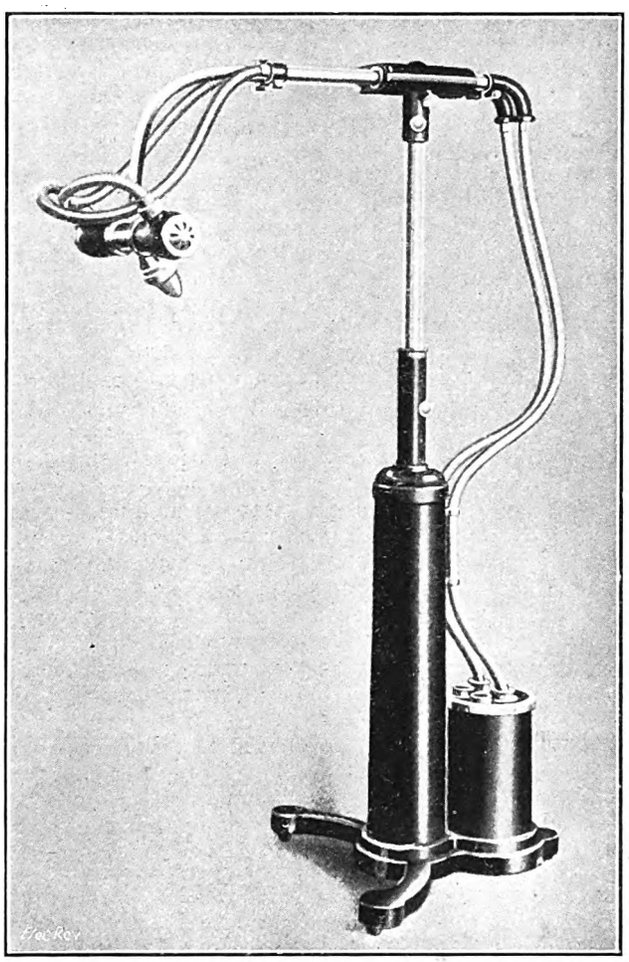

Fig. 7.—Pedestal Pattern Dental Set.

X-ray protection is assured. The power required from the mains is so small that ordinary domestic outlets are suitable, if a.c., and any usual supply voltage. For use on d.c. mains a small portable rotary convertor is available.

Another novel feature is an instrument reading milliampere-seconds used for timing exposures; it consists of a hot-wire movement having a time lag so that a given current maintained continuously will indicate an increasingly greater reading.

A set incorporating two different supplies was shown by Messrs. Schall and Son. It comprises a transformer, valve, and two condensers. For radiography the condensers are not used, and the valve is in series with the tube. An output of over 100 mA at 70-80 kV peak can be obtained, whilst for therapy a smaller current of 4-8 mA at up to 200 kV peak is available. With this connection, due to Villard, the condensers are in series with the transformer terminals, and the valve is connected in parallel with, and back-to-back to, the tube. A switch attached to the housing serves to change the connections from one to the other, and at the same time to change the controls on the trolley, so that, when set for screening, only the controls used for screening are operable. A further switch on the top of the cabinet is a selector switch for connecting the output to any required circuit. Voltage control is by tapping switches on the auto-transformer, and a contactor is used as a main switch. A one-valve set is found to be the most popular, and for chest screening work in particular six-foot radiography (or teleradiography) is on the increase. This tendency was first made public last year by Mr. W. E. Schall at the annual meeting.

(To be concluded.)

High-Voltage Laboratory.

German Two-million Volt 1,200-kVA Equipment.

WHAT is claimed to be the first laboratory for electrical testing at pressures up to two million volts has lately been completed at the transformer works of the Koch & Sterzel Gesellschaft, at Mickten, Dresden, Saxony. That the firm has for many years realised the importance of having adequate facilities for testing electrical equipment is indicated by the steady advance that has taken place; it is interesting to record that it had a laboratory equipped for tests up to 50 kVA capacity at pressures up to 500,000 V as long ago as 1918, which was followed in 1922 with one capable of permitting tests up to a million volts and 200 kVA, while now the capacity has been increased to two-million volts and 1,200 kVA at 50 periods.

The inauguration of the new department took place in the presence of a number of members of the Association of Saxon Electricity Generating Stations and of the Dresden Association of Electrical Engineers. The visitors were received by Prof. Dr. Eng. Koch, who referred in a short introductory address to the continuous progress that is being made in the transmission electrically of power at high voltages, while Dr. Eng. Reiche explained that the new department had become necessary owing to the fact that power transmission installations at a pressure of 220 kV were now coming into general use in Germany, and so necessitated the provision of means for testing the insulators and other equipment necessary for such installations.

In the Koch-Sterzel one-million volt plant three series-connected 333-kV transformers were employed, whereas in the new laboratory there are five, each having a capacity of 400 kV. So far no details of the transformers and

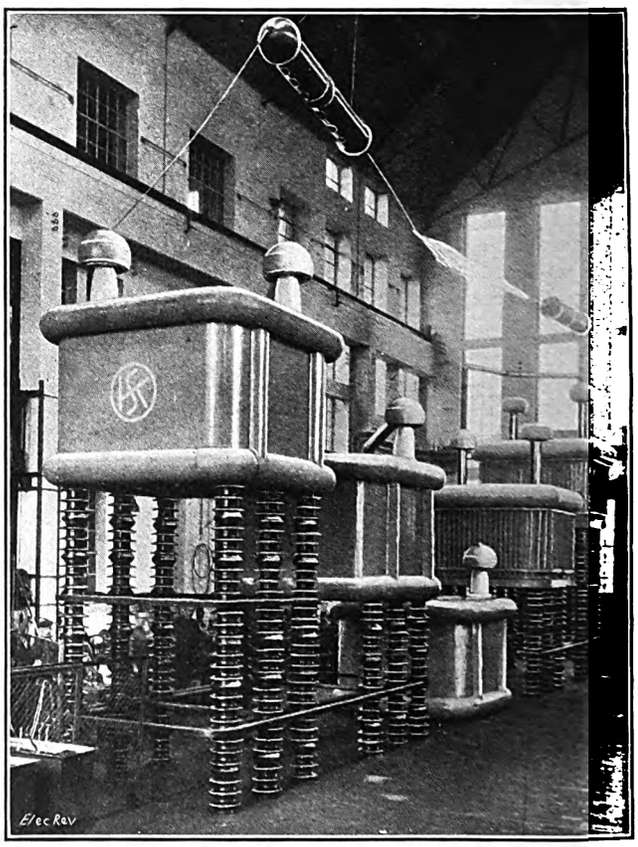

Fig. 1.—Two-million Volt Transformers in Germany.

their connections have been made public, but an idea of their general appearance will be gathered from the accompanying illustration (fig. 1). It will be seen, too, that they are arranged at different heights on insulating stands to correspond with the increase in voltage to earth when the transformers are in cascade connection.

For the benefit of the visitors, the plant was shown in operation, when a two-million volt spark across a gap of no less than 16 ft. was obtained.

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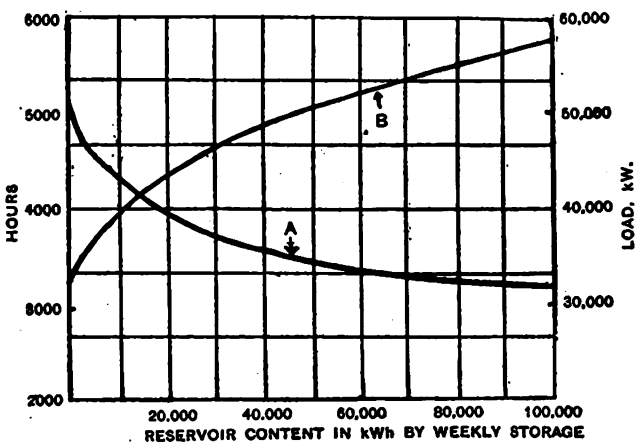
Hydraulic Power Accumulation.

A brief outline of the applications and underlying principles of hydraulic power-accumulating installations, such as are being so widely adopted on the Continent, with reference to the possibilities of this system of water-power storage as applied to steam generating stations

By A. PAGE, B.Sc., A.M.I.E.E., A.M.I.Mech.E.

WATER has always been the greatest essential of mankind. Without it existence on earth would have been impossible, and as water has served our ancestors so faithfully in many ways, it is but natural that new uses for it should be found in the future.



A=Load on steam turbo-generators. B=Duration of operation of steam turb'nes. Overall energy conversion efficiency=60 per cent.

Fig. 1.—Decrease in Generator Capacity with Increase in Storage.

However, with new ways new difficulties are encountered, and we in this country are struggling to overcome one such difficulty in the form of plant load factor by the erection of the national transmission grid.

The present intention in respect of the grid is not so much to transit bulk supplies of power over long distances as rather to ensure that the most efficient stations do the bulk of the producing, and, most important, to provide emergency supplies with the minimum of stand-by plant. Once in commission, however, further practical uses for the grid can be expected, not the least of which *may* be the transmission of power in bulk to sites suitable for its storage until such periods as plant capacity may be stressed. A somewhat analogous problem has occurred on the continent of Europe in connection with large hydro-electric schemes, where this question is of very much more importance. First, there is the exceptional capital outlay on water-power installations, which may be from five to seven times the cost of the equivalent capacity in steam plant. In fact, it is generally assumed that the interest on the additional invested capital of such an installation takes the place of the coal bills of steam stations. Hence, to provide stand-by plant for a hydro scheme is somewhat synonymous to maintaining a steam turbine under full-load steam without normally securing any useful output. In this respect, therefore, it behoves the hydraulic engineer to provide only such plant as is absolutely necessary, and to arrange for it to be in useful commission for as long periods as possible.

Of course, a further aspect of hydro schemes is the utilisation completely of all the water power available, as the overall efficiency should be gauged by the quantity of raw power available and the amount of power made use of. If the maxima and minima of supply and demand synchronised and the machinery employed was 100 per cent. efficient, the overall efficiency would also be 100 per cent. Now, if the characteristics of supply and demand were not identical, there would be a surplus of power at times of low load, and insufficient power at times of peak load, so that the earning capacity of the installation would be adversely affected. The advantages of introducing a flywheel were recognised by the earliest engineers, and with the growth of large interlinked power systems its necessity, whilst not so evident, is nevertheless present. As they are well informed on hydraulic matters, and as their generating stations already utilised to a great extent water power, it is but natural that the art of hydraulic accumulation should have been cradled by continental engineers. They determined that it was a comparatively simple matter to add a pumping set to an existing station and, during times of light load, to store water in an elevated position, thereby not only providing additional power for meeting peaks, but also utilising to its full extent all the water power available.

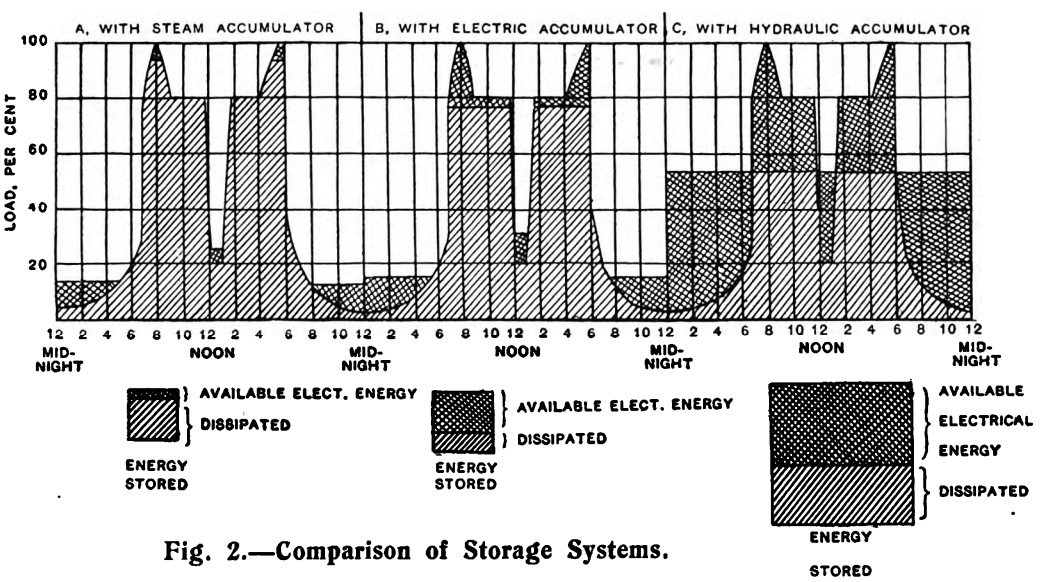


Fig. 2.—Comparison of Storage Systems.

To make the position clear, if 50,000 kW can be gene-

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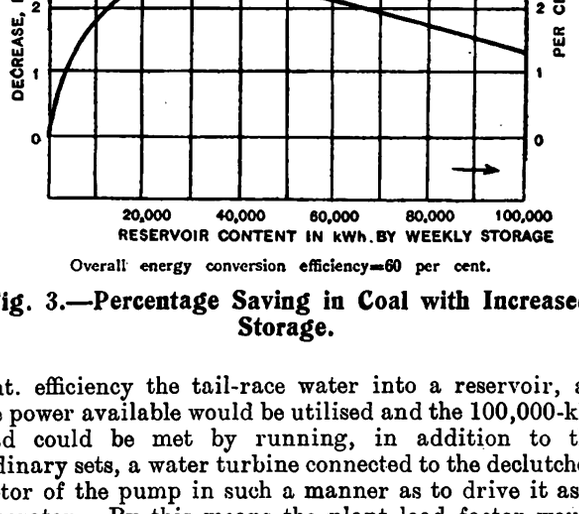
rated continuously from a certain water fall and the load to be met, assuming an extreme case, is 100,000 kW for 12 hours per day with no load during the remaining time, it is obvious that without accumulation only 600,000 kWh can be generated, whilst an equal amount runs to waste. Now, if during the no-load period energy were developed and employed in pumping at 100 per



Overall energy conversion efficiency=60 per cent.

Fig. 3.—Percentage Saving in Coal with Increased Storage.

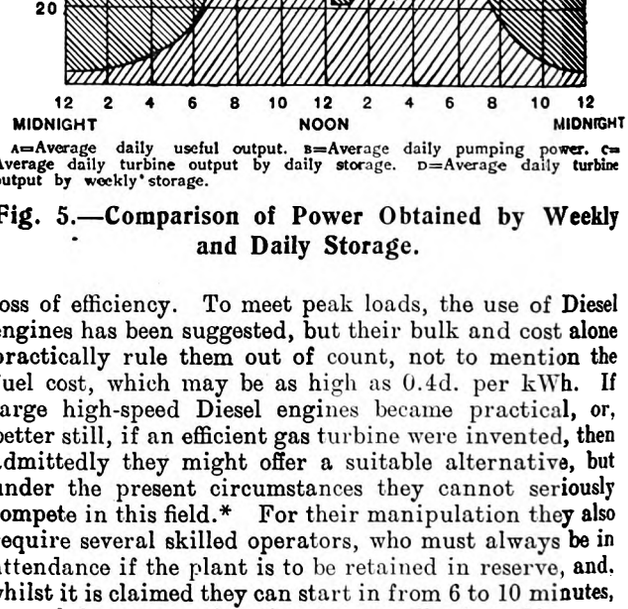
cent. efficiency the tail-race water into a reservoir, all the power available would be utilised and the 100,000-kW load could be met by running, in addition to the ordinary sets, a water turbine connected to the declutched motor of the pump in such a manner as to drive it as a generator. By this means the plant load factor would be raised from 50 to 100 per cent. From fig. 1 it will be seen that as the amount of energy stored increases, the load factor is proportionately improved, and the output required from the main generating sets becomes smaller. In other words, with the same sized generating sets a much greater peak can be met if hydraulic accumulation is employed and, instead of extending the generating station proper, it can be made to operate for longer periods on a base load, the energy stored being delivered to the network when necessary.

Installations of the above description were, of course, first employed at favourable sites and sometimes meant only the addition of a pump, motor, and water turbine to the existing plant. It is also obvious that the greater the pumping head, the smaller the size of pumps, turbines, and reservoir needed for the same storage capacity, so that instances are extant of raw water power having a low head being utilised for pumping water to a much higher head. In this manner the idea of power storage by water has become established practice and pumping sets absorbing 25,000 h.p. apiece are in operation.

Fig. 4.—Variation of Coal Consumption with Load Factor.

On embarking on such schemes, other existing methods of power storage have come under review, the most prominent devices of the kind being the steam accumulator and the electric storage battery. The steam accumulator is being successfully employed in industries requiring process steam to even out the fluctuations in demand for steam and power, and in one notable instance in Berlin, Germany, it is being applied to a central steam electricity generating station, where 24 vertical accumulators are being erected to operate in conjunction with three 20,000-kW sets. The economy of such an installation has yet to be proved, and therefore it can only be meanwhile looked upon as being in the experimental stage. Its inherent weakness when large capacities are under consideration is the large and costly containers, in which almost 10 times the weight of water to the weight of steam must be stored. The insulation of the containers, which must of necessity be out-of-doors, is of no small importance, as well as the adverse effect on turbine efficiency of dry saturated steam varying in pressure between 200 and 20 lb. per sq. in. being employed. Further, if the turbines are to act as an *instantaneous* reserve, they must be constantly run idle, so that their no-load steam consumption has to be reckoned with. Under the most favourable conditions the estimated steam consumption of such an installation as that outlined above is stated to be 18.7 lb. per kWh, or from 60 to 65 per cent. greater than is normally obtained with ordinary sets, and this figure still does not take into account the no-load losses.

Electric storage batteries suffer seriously from the burden of heavy capital and maintenance costs, but what is more important in their case is that they can only deliver and receive direct current, which is seldom applicable to large networks except by the introduction of motor generators, which results in further cost and



A=Average daily useful output. B=Average daily pumping power. C=Average daily turbine output by daily storage. D=Average daily turbine output by weekly storage.

Fig. 5.—Comparison of Power Obtained by Weekly and Daily Storage.

loss of efficiency. To meet peak loads, the use of Diesel engines has been suggested, but their bulk and cost alone practically rule them out of count, not to mention the fuel cost, which may be as high as 0.4d. per kWh. If large high-speed Diesel engines became practical, or, better still, if an efficient gas turbine were invented, then admittedly they might offer a suitable alternative, but under the present circumstances they cannot seriously compete in this field.* For their manipulation they also require several skilled operators, who must always be in attendance if the plant is to be retained in reserve, and, whilst it is claimed they can start in from 6 to 10 minutes, a much longer starting time is normally desirable.

Even if the main disadvantages of all the systems alluded to were successfully overcome, they would still be inferior to water-power storage, as, unless they were of exceptional size, they could not hope to cover more than a small part of the actual peaks. Against this, it is possible so to proportion the reservoir of an hydraulic-accumulating installation that the main power sets are continually operated at almost 100 per cent. load factor without unduly increasing the size of the additional pumping sets. This is brought out more clearly in fig. 2, which is fairly representative of the possibilities of the various systems and indicates the substantial manner in which hydraulic storage can be employed for smoothing

* See ELEC. REV., June, 14th, p. 1074; June 21st, p. 1119; July 19th, p. 134, 1929.

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out the load curve. The importance of a good load factor needs little comment, except to add that, as the Parson's line of any station is made up of a constant no-load loss plus an amount dependent on output, the coal consumption per kWh is also bound to decrease with the load factor. The subject of the economy of hydraulic accumulation as applied to steam stations was raised at

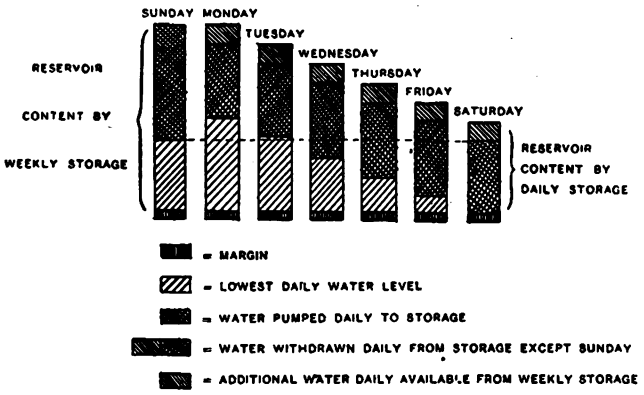

Fig. 6.—Comparison of Reservoir Capacity by Weekly and Daily Storage.

the World Power Conference in 1926, and as a result a detailed investigation of the position was published by Mr. A. Maas in the *Water Power Year Book*, 1925-26, the conclusions of which are summarised in fig. 3. From that curve it will be appreciated that with an overall storage efficiency of 60 per cent. an improvement in steam consumption of nearly 3 per cent. can be expected.

At this stage it is important to note that the gain in efficiency is not progressive, but there appears to be a definite economical storage capacity for every installation beyond which an increase in energy stored may result in a loss of efficiency. This fact will be appreciated when the extreme case is considered of storing all the energy before it is delivered to the network, as in such circumstances there would be a definite loss equivalent to the inefficiency of conversion. The prevailing load factor in this country is in the neighbourhood of 30 per cent., which, as fig. 4 indicates, is on the steep part of the load factor—coal consumption curve. Therefore, the improvement in coal consumption is not so marked at the higher load factors as at the lower ones, and at a particular point the additional loss in energy conversion compensates for the decrease in coal consumption. Now, if capital charges per kWh were plotted along with the coal costs on a basis of load factor, they would form parallel curves of a similar contour to the coal consumption characteristic shown in fig. 4, so that the above argument applies equally to the cost per kWh generated.

A further important feature of water-power storage is that the energy can be made practically instantaneously available without incurring any additional losses, or no-load losses, and it therefore has a decided advantage over such systems as steam accumulators. Its application in this country should be further assisted by the erection of the grid, as some of the transmission lines will undoubtedly traverse country decidedly favourable for hydraulic storage. In fact, the choice of sites can be arranged almost irrespective of the power stations and of the localities of demand, except in so far as transmission losses enter into account. There will naturally be an economic limit to the distances between power station, storage site, and consumer, but the available radius will permit of a reasonable latitude in the choice of site. It must not, of course, be considered that only heads of 1,000 feet or more are essential, as some existing installations (Hemfurth) are operating economically under only 100- or 150-foot heads, and in some cases a 70-foot head is suggested as practical. It goes without saying that the higher the head the smaller the entire plant and reservoir need be for the same output, as less water has to be pumped, and with a higher head a higher speed can be employed. Also, as the circulation of water is less, the overall efficiency is greater, but in spite of this fact medium-pressure heads form quite a sound proposition. This remark also applies to the question of capacity, as although with large systems large hydraulic accumulators are the rule (at Neiderwartha the pumps are rated at 25,000 h.p. each), it is nevertheless true that in certain instances (Mittweida and Tubingen) it has been found economical to install pumps of only 300 or 400 h.p. capacity. No hard and fast rules can be stated for the range and method of application, as they depend on so many factors, which in each case require individual consideration.

A point having an important bearing on the matter is the method of storage, *i.e.*, whether weekly or daily storage is employed. Most municipal power systems have a daily characteristic load curve in summer much as shown in fig. 5, the peaks representing the time when industrial load is carried. On Sundays and holidays a very small steady load usually prevails, so that, if desired, those periods, in addition to the daily periods of light load, can be employed for storing energy. By accumulation at week-ends one-sixth of the water pumped can be utilised during week days; fig. 6 shows the distribution of storage capacity over one week under such circumstances. The cross-shaded parts indicate the water pumped per day, which, except on Sundays, is re-utilised daily, together with the aforementioned part of Sunday's storage. Under daily storage conditions the dotted line would represent the capacity of the reservoir, which would be filled and emptied once per 24 hours.

Employing efficiency factors of 80 per cent. for the pump, 82 per cent. for the turbine, 97 per cent. for the pipe-work when pumping, and 94 per cent. for the pipe-work when under turbine operation, it can be shown that if the pumps operate for 14 hours per day and the water turbines for 10 hours per day, then the turbine load carried will equal 1.08 times the hourly pumping load. Letting x equal the ratio of pumping load to pumping head, the daily quantity of water pumped in cubic metres per hour (1 m³ = 35.3 ft.³) will equal 3,000 x. Now, if in addition to the above it is possible to pump at the same rate on Sunday for 22 hours, the size of the reservoir required will equal 7,500 x, or 150 per cent. greater than with daily storage alone. The daily water quantity then available for power generation will equal 3,750 x, or an addition of one-sixth of 4,500 x, which is pumped on Sunday. From this it will be seen that 25 per cent. greater output can be obtained by pumping at week-ends, but a much greater reservoir is necessary. To raise the daily capacity 1 per cent. by week-end storage means 6 per cent. greater reservoir

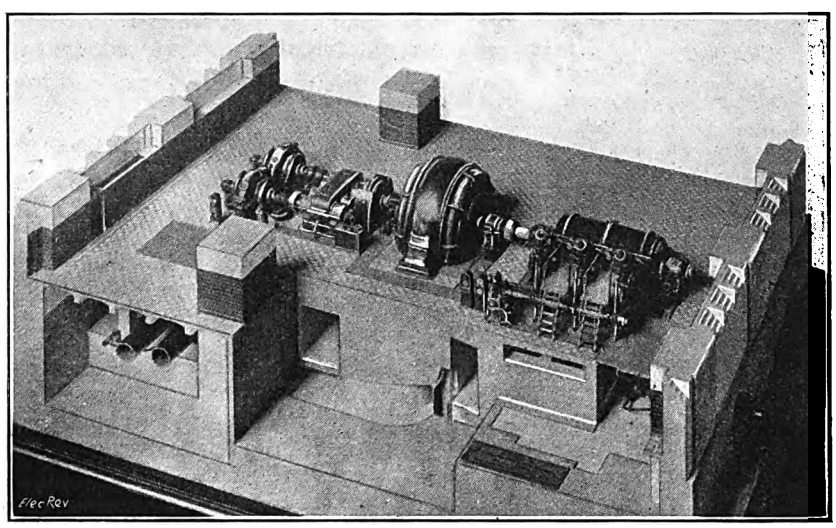

Fig. 7.—Sectional Model of Hydraulic Storage Plant.

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capacity, and experience has shown that the most economical size of reservoir is in the neighbourhood of 4,000 *x*.

In fig. 5 the chain-dotted line A represents the average hourly load delivered to the network; line B gives the average pumping capacity during the 14 hours of pumping. With daily storage, line C would indicate the average power returned to the network over the 10 hours during which the turbines are in service, which, as already shown, would be 1.08 times the pumping load. If week-end storage were possible, the average turbine load delivered to the network would be increased to line D, which is 25 per cent. higher than line D.

Fig. 7 is a model representing a typical engine house for water-accumulation plant. On the right will be seen the pelton-wheel turbine, which has three runner wheels, each served by automatically-controlled needle jets. When delivering power to the network this turbine drives the adjacent synchronous motor as a generator, the large magnetic clutch of which, on the left-hand side, is out of action. When storing power the water turbine is shut off, the electric clutch energised, and the pumps on the extreme left are driven through intervening gearing by the generator now employed as a motor. In many instances the same pipe-line is used for conveying the water from the pumps to the reservoir and for returning the water later to the turbines. To maintain efficiency at partial loads the pumps are fitted with automatic vane-adjusting devices, so that the pumps are very similar to reversed spiral-casing water turbines. The reason for introducing two pumping sets in place of one is rather interesting. Assuming the individual pump efficiency to be 80 per cent., 63 per cent., and 37 per cent. at full, half, and quarter loads, respectively, if one set were employed and run at half load its efficiency would be 63 per cent., but by having two units and cutting out one pump entirely, 80 per cent. efficiency could still be maintained. Similarly, at a quarter of the full pumping capacity the efficiency will be raised from 37 to 63 per cent. by having the twin arrangement and running only one pump. The gear losses of such sets only amount to 1 or 2 per cent. and may be neglected, whilst an additional advantage of the subdivision of the pumping group is that in the event of a breakdown of one pump half the capacity is still available.

Owing to progressive improvement in the efficiencies of both pumps and water turbines, hydraulic accumulation is coming much more to the fore. Water turbines are already in operation giving 93 per cent. efficiency at full load and 88 per cent. at half load, whilst the efficiency of large storage pumps is in the neighbourhood of 86 per cent., so that an overall efficiency of from 65 to 70 per cent. can be realised by this method of storage. Even this loss is to a certain extent discounted by the improved steam consumption resulting from the higher load factor, so that there is much to recommend its adoption, even in this country. Provided a suitable site is available, that is, one having upwards of 70 ft. head and located reasonably near the power system, then we already have to hand a means of improving our load factor far beyond the most optimistic expectations we may harbour for off-peak load tariffs.

Electricity for the Home.

A constructive criticism of the present methods and practices of manufacturers of electrical cooking apparatus, based on experience obtained from the supply undertaking's point of view.

By A CONSUMERS' ENGINEER.

THERE are at present at least thirty firms in Great Britain which are turning out electric cookers of one sort or another, and to one who has some knowledge of the early days of cooker development it is rather amazing to see them incorporating details which were abandoned years ago by the earlier makers. A manufacturers' representative, when asked recently why his firm had done a certain thing, replied: "because so and so asked for it, and if we do not do it for him someone else will, and we shall lose his order." The firm knew from its own experience that it was wrong, but it was forced into the position of having to do it, because some buyer, due to lack of experience, insisted on it.

The rapid increase in the number of undertakings buying cookers during the last few years seems to have created a position in which there is a comparatively large number of new manufacturers on the one hand, and new buyers on the other. These people, by weight of numbers, appear to be discounting the knowledge of design and the experience of cooker performance which have been acquired by the smaller number of manufacturers and buyers of longer experience.

That this is so appears to have been recognised by certain bodies, such as, for instance, the I.M.E.A. and the B.E.A.M.A., which some time ago set up a joint committee to consider cooker design. Whether or not the result of this committee's work will be sound will depend to a large degree on the relative representation of the two classes of maker and buyer, that is the old and the comparatively new.

The design and construction of a good cooker are not matters which can be done on an ordinary engineering basis. It is possible to design a cooker which may be perfect from the point of view of thermal efficiency, for instance, and yet be a complete failure as a cooker from the users' point of view. Likewise, the selection of a good cooker cannot be made on the strength of laboratory tests, however comprehensive they may be. Such tests give some useful indications from which deductions may be drawn, but the choosing of a cooker is a matter of judgment more than anything else. Cookers are being put into service to-day which in a short space of time will disappoint their present buyers and their future users. This will do a lot of harm to the development of the cooking load, for a consumer who has tried an electric cooker and has not been satisfied is worse than one who has never used such apparatus. He will not try again in a year or two and, what is still worse, on the strength of his past experience he will deter future prospective users from trying something which may be much better in design and performance.

What then are the points which should be kept in mind by both the maker and buyer of a cooker? The first is that the primary function of a cooker is to cook, and not to be a piece of apparatus with the highest possible thermal characteristics. This does not mean that thermal efficiency is of no importance, but that it is not of such importance as many appear to think it to be at present. The second is what will be the condition and appearance of the cooker after it has been in service some years? It is all very well to say that such and such a cooker has a beautiful finish, but the point is whether that finish will last. Bear in mind that the probability is that for many years yet consumers will hire their cookers, and, if the cooker loses its nice finish when in service, it

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will either come back to you, or else cost you money to recondition it. Fancy finishes should therefore be regarded with caution. It must further be borne in mind, in this connection, that electric cooking attracts the "crank" as well as the sensible housewife, and one of the former will cause you more trouble than a score of the latter.

Let us take a cooker more or less in detail and deal with points as they arise.

The finish should be attractive so far as this is compatible with reasonable cost and enduring qualities. Present practice is to use coloured enamel, wherever possible. On the hob-plate and any removable parts this is now wise, though it is only within the last year or so that enamels which are reasonably free from chipping and scratching have been obtainable. The enamelling of the cooker body should, however, be avoided. A stoved black enamel is still the best for that part. A hob or any removable part can be taken away and re-enamelled at comparatively small cost, but not so the carcase. Moreover, the carcase is the part which is most likely to be damaged, both in transit and on the customer's premises. Nickel-plating of the hob and raised parts has a lot to be said for it, in spite of enamelling. It is a bit more costly, but it gives the cooker a bright appearance, and is easily cleaned. If this is done, however, the hob surface should be left matt and not polished bright, as it will then not show the scratches made by pots and pans. White vitreous enamelled door panels and oven sides on a stoved black cooker look very well, and are not costly to maintain.

The best oven shape depends to some extent on the size of the oven. For general hiring purposes I am convinced that the best is the "high" or gas-oven shape. Some raise objection to this because it is "following the gas people," but why did the gas people standardise it? This shape gives the greatest amount of useful shelf area, with the smallest demand on floor space. This is not so important in a floor-type cooker as in a table cooker, as in the former case the deciding factor is the area of the hob. The disposition of the heating elements is perhaps the point of greatest controversy about an oven. For a high oven, side heating is correct, but some attention must be given to the actual location of the heaters, otherwise even distribution of heat may not be obtained. There is at least one oven on the market which would be quite good were the position of its elements altered, but which at present is associated with uneven heating. For an oven of the wide or coal-oven shape, side heating with some bottom heat is correct. One disadvantage is that the introduction of bottom heat increases the cost of construction. Ovens of this shape are, however, more popular at the moment than high ovens, but sooner or later there will be a reversion to the high one. Probably the chief reason for their present popularity is that they look bigger, but experience soon proves otherwise. Pull-out interiors are popular, but they will not remain so. Such an oven is slower than one with a fixed interior, unless its loading is increased, because there is a bigger proportion of non-useful capacity; moreover, the mass of metal inside the oven is increased somewhat. To reduce this increase to a minimum there is a temptation to use a flimsy construction, which soon commences to give trouble by reason of buckling, and becomes difficult to get in and out for cleaning purposes, thus defeating its own object. Welded linings are another feature; they are good, provided two points are kept in mind: first, that provision is made to prevent buckling, either inward or outward, and, secondly, that adequate provision is made for ventilation, particularly if such operations as bread baking are to be catered for. In earlier cookers, which had either wrapped or riveted linings, moisture was able to escape through the joints, but in an oven with welded linings this is not so, and good results will not be obtained unless surplus moisture is got away. This is one of the reasons why an oven of good thermal characteristics is not necessarily a good baking oven. It it sometimes argued that a coal oven has no ventilator, but the fact is overlooked that such an oven has riveted linings, around which the flames or hot gases from the fire circulate, and that the surplus moisture is thereby drawn out and passed away to the flue. If it were not for the effect of this moisture on slag wool, which is the most widely used lagging medium, quite a lot could be said for riveted, or spot welded, linings. The enamelling of oven interiors may nowadays be regarded as safe. It is very desirable from a hygienic point of view, but while non-friable enamels were not obtainable it was not wise to go beyond the enamelling of element guards and door panels, which could be easily renewed in case of chipping taking place.

Stainless-steel is probably the ideal for the interior, but at present cost forbids its use. Chromium-plating may also offer some possibilities in the near future. Runners for shelves should be plentiful, easily cleaned, and so constructed that the shelves run freely, not only when new, but for so long as the oven shall last. One of the most frequent complaints so far as ovens are concerned is the difficulty of getting shelves in and out.

Thermometers are very debatable appliances. If they gave to the user a true indication of the air temperature inside the oven they would be a most useful adjunct; but they do not, because it is practically impossible to shield the bulb, or, in the case of a metallic indicator, the metal housing, from the element radiation. They also have a lag which cooks will not take into consideration when opening and closing the oven door. The only really useful function which a thermometer or an indicator can serve on an electric oven is to guide the cook who wishes to heat up an oven which has already been partly heated, as, for instance, raising to pastry temperature after having cooked luncheon and served it up. All other temperatures should be obtained on a time basis. In isolated cases, where there is voltage variation, this might present a little difficulty at first, but the effect of such variations, where they do exist, is not nearly so great as that of a change of wind on a gas or a coal oven. Door fastenings and hinges should be such as to ensure that the door makes a practically airtight fit on its frame. The door should not be allowed to act as a ventilator. Many a good oven is spoiled by a bad door catch. The chief duty of a catch is to keep the door properly closed, but it must also be easily opened and easily closed, otherwise it is not a good catch.

Now we come to the item which is the cause of nearly all the trouble, namely, hotplates. The shape of plates has in the past been largely determined by the ease, or otherwise, of manufacture, rather than by their relative usefulness, and rightly so, as there is not a great deal to choose in the latter direction when one takes into consideration the many sizes of pans which are used in several combinations on different days of the week in various kitchens. On the whole, observation shows that the rectangular plate presents the smallest amount of uncovered plate area, in general use, and is, therefore, all other things being equal, the best shape to use. Such a plate has the further advantage that it can be split to form two other smaller rectangular plates, to much better advantage than can a square one, though on this head it cannot claim much, if any, advantage over a round plate divided into two concentric portions. With regard to types, there are three, *viz.*, open, protected, and solid. At present the latter holds the field, but this is only a temporary phase, and the plate which comes to stay will be an open one. Probably the reason for the solid plate being in demand at present is that all the comparatively new cooker users began using cookers when badly designed open or protected plates were being used in an attempt to get away from the deadly slowness of the old solid plate with clamped sandwich elements. When they found that those plates were not perfect they turned to the newer solid plate, which, while admittedly far ahead of the old ones, still possesses the troubles which must be inherent to any such plate, which troubles are of great concern to the user.

As with ovens, so with hotplates. Their chief function is to cook, and not to give the highest possible thermal efficiency. A plate may have a high efficiency and make a good water boiler for boiling vegetables, but be an absolute failure when it comes to cooking as distinct from plain boiling.

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The essentials of a plate are speed, reliability, and flexibility, and unless it has all three it is not a good plate. Open plates have the first, if properly designed, and the third. Solid plates of modern design have the second, but not the first and third. Protected plates have all three, in varying degrees, according to design, and are therefore the correct type, or rather the best proposition at the present time, notwithstanding the apparent popularity of the solid type. For long-period duty, such as is met with in cafés and canteens, the solid type is probably best at present, but for the domestic cooker its slowness in heating up from cold, and its heat capacity when hot, make it unsuitable. A further disadvantage is that flat-bottomed pans are almost essential, and these are a costly item for the consumer to provide. In their endeavours to get speed, manufacturers have, in some instances, entirely overlooked the duties which a hotplate has to perform. It is absolutely useless to crowd a high loading into a confined area. The plate itself may stand up to it, but it will be the ruination of any substance on the plate containing carbonaceous matter, by burning it. There is a limit to the amount of heat which can be absorbed by any substance, per unit of area exposed to heat, and it is useless to go beyond that limit.

The problem is to increase the area of application, and not the intensity. The use of pans with flat bottoms is one way of doing this, so far as solid plates are concerned, and in modern solid plates further assistance is given by reason of the fact that the element is distributed over a much greater portion of the area of the plate than was the case in the older type of plate in which the actual element area was only about half the plate area. The ideal to aim at is to absorb, in the most even manner, by the body of the vessel containing the matter to be heated or boiled, the whole of the heat dissipated by the plate. This may at some time be possible by induction, but the only feasible way at present is by radiation, and it is therefore the open-type plate which should be developed. A cooker recently introduced in America has this principle, though it remains to be seen whether or not it is correctly applied. A somewhat similar plate has also been on the English market for some time, but in both cases the type of element used and the manner of fixing do not appear to be correct.

Until some material other than nichrome is produced from which to make up the elements, the definitely open type of plate will not arrive. A properly designed protected-type plate will protect the nichrome from the ill-effects of a "boil over," but it will not stop oxidation. To afford this protection, however, it is necessary to remove the element from its desired proximity to the utensil, and so reduce both speed and efficiency. Careful design and the choice of a correct means of protection can, however, result in the production of a plate which is as efficient as an open plate (in the present stage of its development) with the added advantage of the reliability of a solid plate, and the further advantage that in the case of a fault only part of the plate need be replaced, whereas with a solid plate the whole would need to be changed.

With grills, again there is a demand for speed at present, but those who ask for it do not know what is really meant by grilling. It might be defined as the application of radiant heat of certain temperature (or intensity) for a definite period, according to thickness of the object to be grilled. If more or less time is taken the food is not properly grilled. The aim when designing a grill, therefore, should be to see that the applied heat is such that a steak or chop, or whatever it may be, is correctly grilled when subjected to that heat for the correct time. Go into a good grill room and tell the chef that you want a grilled steak in five minutes; your ears would not get grilled, but they would be burned by his remarks, and so would the steak, *if* he did it. There is a tendency at present to load grills up and to supply three-heat regulation. There is no objection to the latter, apart from extra cost, and it has a distinct advantage when the grill is also used for warming the hot cupboard. One way in which grills might be improved would be by making them of a greater area. There is difficulty, of course, in doing this without increasing the area of the hob, and consequently of the floor space required, but it is worth bearing in mind.

Much more might be said about cooker assembly, position of fuses, switches, hotplates, hot cupboard, and methods of wiring. The object of the article, however, is to deal with the application of heat in the essential parts of the cooker, so as to obtain good results from the users' point of view, rather than from a purely engineering standpoint.

Railway Claims.

Some Notes on Compensation for Loss or Damage.

By J. W. PARKER, A.M.Inst.T.

CLAIMS against railways arise under two separate headings: in the first place, there is the matter of legal "damages" in connection with questions of individual rights in property, &c., and secondly, there is the more common procedure arising from breakages or loss of goods handed to the companies for safe transit. In the ordinary way railways are insurers of the safe arrival of goods; consequently any substantial failure to carry out the spirit of their guarantee has to be met with monetary compensation. Unfortunately for the trader, however, the procedure is so hedged around with regulations and customs that unless considerable care is exercised compensation is lost because one has failed to comply with some requirement.

The "out-of-date" claim is a case in point. Nearly everyone has fallen foul of this proviso at one time or another and has in consequence been unable to secure satisfaction. Next to lack of knowledge, misconception is probably the most prolific cause of trouble, many business people having the erroneous belief that only the party paying the carriage is entitled to make a claim. There is no rule on this point recognised by the railways, and it will be found that they will negotiate with either party, their only concern being to avoid paying the same demand twice. If both parties lodge a claim, the railways will secure the withdrawal of one before proceeding to negotiate with the other claimant. They will, however, verify for themselves whether the carriage has been paid and, if not, will refuse to allow the equivalent sum in the compensation amount. As to which party ought to put in the claim depends upon several things. There is much to be said for the bigger firm undertaking the duty, as it is clearly better able to do this than a small retailer. Not only is it more likely to have the specialised knowledge and organisation at its command, but its very size gives a greater influence and bargaining ability than the small firm can possibly possess. Moreover, the preferment of claims in a large organisation can for the most part be resolved into a smooth running routine needing a minimum of supervision.

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In the case of special and technical products like electrical machinery, it is generally better to leave claims negotiations in the hands of the senders as they know the characteristics of their own products better than anyone else. Thus when any dispute arises the sender has the facts before him. It should, however, be borne in mind that all the larger companies have extensive works of their own, and consequently a staff of electrical engineers competent to express opinions from the transport standpoint. Questions of doubt are usually referred to a Railway Clearing House Committee consisting of these experts, and they are the deciding factor. At one time the railways were wont to use generous claims settlements as part of their inter-line competition and make a good allowance for damaged goods or salvage as a means of securing traffic from a competing railway, but to-day this is no longer possible, all demands involving more than one company being settled by all railways in conference through the medium of the Clearing House Joint Claims Committee.

Since the enforcement of the standard conditions of carriage referred to in a previous article, the lot of the trader in respect of claims has improved in one respect. He is now allowed seven days for making the written claim as against three previously, providing notice is given in writing within three days. Despite this, a large number of otherwise sound demands continue to be rejected through the laxity of the consignee, and unfortunately the loss falls not on the receiver but on the sender, who is almost invariably innocent. The only complete remedy for this appears to be an educational campaign within the industry. In those cases where damage cannot be accurately ascertained until repairs have been executed, the position can always be covered either by a " claim anticipated " statement, which is a claim without amount, or by making a rough estimate which is to be corrected later. Allied with this question is the matter of salvage inspection and disposal.

In all cases of damage, derangement, or breakage, the railways should be asked to inspect the remains of the consignment before they are disturbed. Failure to observe this precaution is likely to lead to complications and delay when the time for settlement arrives, as no railway likes to pay a claim until satisfied as to the salvage. Up to three years ago dissatisfaction existed in some quarters owing to the arbitrary way in which the railways dealt with claims on goods carted by the traders themselves. They argued that they had not the handling and complete control of the traffic throughout the transit when the trader performed collection or delivery, and they insisted on making a percentage cut on all claims arising under these circumstances. This amount varied in different localities and between various trades so that industry as a whole did not know the exact position. The matter was taken up as a national question with the result that a uniform percentage was agreed between the parties.

The amount of time and clerical work involved in making claims for small amounts has been found by experience not to be worth the trouble taken, hence the majority of large firms come to an understanding whereby demands for amounts not exceeding 1s. 6d. or 2s. are automatically cancelled, and in return, larger amounts are met in full. Whilst it must be conceded that a considerable amount of time is necessary to investigate claims, it should be kept in mind that it is the trader who is standing out of his money during the inquiry, and the interval between lodging a demand and receiving payment should not be too long. Some recording method should be introduced whereby a trader can watch the progress of his claims and issue reminders in cases of delay.

A widespread impression exists that claims cannot be established on goods consigned at owner's risk, but this is only partly right. Whilst it is difficult to secure compensation, circumstances do arise under which a demand can be successfully made. Broadly speaking, it is necessary to prove wilful misconduct on the part of the railways, which is not easy, if only from the fact that nearly all useful evidence is in the hands of the defending party—the railway itself. It is true one can go to law and compel the production of witnesses, but as a practical remedy it is as cumbrous as it is unsatisfactory. Much better is it to rely upon the doctrine of *res ipsa loquitur* —the thing speaks for itself. If, for example, electrical goods at owner's risk pass from " B " to " C " regularly without damage, but on one occasion a consignment packed, handled, and loaded in precisely the same manner as the previous half-dozen is found to be badly smashed, a clear presumption of wilful misconduct arises which should be pressed home. The occasions when this can be proved will doubtless not be frequent; hence, three further exceptions under which it is possible to make a sound claim will be welcome. The first one is non-delivery of a properly addressed and packed consignment, unless the failure can be proved to be due to train accidents or fire. Secondly, pilferage is a good ground for making a claim provided the goods concerned are protected by packing more adequate than paper or other easily removed covering. In the third place, misdelivery will be recognised where goods are not tendered within 28 days. In any of these instances, however, the railways have a loophole if they can prove that they have not been negligent. Although the provisos and exceptions make owner's risk matters somewhat complicated, there are distinct opportunities of securing redress, given a little application of the rules.

There is one point regarding claims which makes common appeal to all interested parties, and that is prevention. Senders, railways, and consignees all incur loss of some kind when damage, breakage, &c., occur, as the sender has the trouble of duplicating the order, the consignee suffers delay and possibly loss of trade, and upon the railway falls the duty of reimbursing one of the parties. Recognition of this unpleasant fact has caused a certain amount of joint effort in the past towards eliminating the cause of loss. Much still remains to be done by co-operation in the way of improved packing, labelling, stowing, loading, and other handling and transport problems, and only by a closer joint examination of the issues can the needless economic waste be reduced and ultimately eliminated.

Wiring Rules in Australia.

THE work of revising and promulgating the electrical wiring rules originally prepared by the Institution of Engineers, Australia, has now been taken over by the Standards Association of Australia and committees in each State have been formed, being mainly the same as those originally appointed by the Institution. The Sectional Committee of the Standards Association controlling the sub-committees, which has been in conference in Sydney recently under the chairmanship of Sir George Julius, B.Sc., is composed, amongst others, of representatives of the electricity supply authorities, Fire and Accident Underwriters' Council of Australia, contractors' supply houses, and the Institution of Engineers, Australia, and is thoroughly federal in character. The Committee considered an analysis and review of regulations existing in all countries, which had been drafted and submitted to each State sub-committee for comment, and decided upon a scheme of procedure that provides for a complete revision and re-arrangement of the present rules. New rules are to be added to cover more fully the growing demands of radio installations, neon signs, and welding and X-ray apparatus. To take care of revision and interpretations, a Federal Executive Committee, with representatives in each State, has been appointed. The Committee, which will work in conjunction with the State sub-committees, has decided to proceed immediately with the revision of that portion of the rules covering low- and medium-pressure installations, mining accessories, and apparatus. The main object of the re-organisation is to secure a code of rules applicable to the whole of Australia.

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Fuel Physics.

Problems which are not capable of chemical solution.

A LECTURE on "Physics in Relation to the Utilisation of Fuel" was recently delivered, under the auspices of the Institute of Physics, by Dr. C. H. Lander, C.B.E., Director of Fuel Research, who said that in every stage from the getting of coal to the efficient utilisation of its heat of combustion, physical as well as chemical considerations were of the greatest significance.

Coal was commonly classified upon considerations of its volatile content, flaming characteristics, or ultimate chemical analysis, but scientific workers were gradually realising the important bearing of the actual nature of the coal substance, including its physical structure, upon fuel problems. The aid of the microscope, for instance, had recently been widely enlisted for the examination and classification of coal, and the identification and co-relation of coal seams. Two methods were now commonly employed: either a thin section might be prepared for examination by transmitted light, or a surface of the specimen might be polished, and, if necessary, etched for examination by reflected light.

The application of X-rays to the examination of the ash of coal had recently been developed in this country, and was yielding useful results, the method depending upon the difference in transparency to X-rays of the organic coal substance and the inorganic ash constituents. From the results so far obtained, it seemed probable that improved technique would render the method a rapid means of determining the distribution, nature, and amount of the ash in coal, which had an important bearing upon problems of coal washing.

Attempts had also been made to gain further information of the structure of coal and coke by means of an X-ray spectrometer. This work apparently demonstrated the presence of graphite in each of the types of coke examined; moreover, when four widely different varieties of coke were investigated, distinct parallelism was observed between the size of the graphite crystals, as indicated by the shapes of the resultant reflection curves, and the reactivity of the coke, as determined by the Fuel Research Station method, the most reactive coke apparently being made up of the smallest crystals, and *vice versa*.

This method was an interesting illustration of a physical method of attack proving of assistance in unravelling problems which, so far, had not proved capable of a satisfactory solution on purely chemical lines. The best and most accessible seams having been worked first, the necessity for the more general adoption of coal-cleaning operations had in recent years become apparent.

All commercial coal-cleaning processes depended upon differences in the physical properties of the impurities and of the coal itself, but some of the mechanical principles underlying coal-washing plant were by no means completely understood.

Complete and efficient combustion involved considerations of both chemical and physical natures. A considerable amount of attention has been given during recent years to the design of burners and combustion chambers for pulverised fuel, but uncontrolled turbulent motion did not represent a completely satisfying solution of the problem of securing rapid relative motion of the coal particles and air. It appeared that what was needed in practice was to obtain stable and streamline motion of air, and to induce the particles of combustion to move from one streamline to another in as controlled a manner as was possible. The primary combustion air might, for instance, be arranged to form a vortex, with air entering at the perimeter and leaving axially, the powdered fuel being injected into the vortex at any convenient point, or points. The particles of fuel, in addition to being carried round with the moving air, would tend to move radially across the streamline under the combined action of centrifugal force and the inward pressure gradient due to the radial distribution of the velocity in the vortex; such radial motion would be opposed by ordinary frictional air resistance, the air possessing a steady inward radial component of flow owing to the inflow at the perimeter and outflow at the axis of the vortex. In that way the particles would be scrubbed by a continually changing atmosphere, and it might be possible to cause them to remain suspended in the vortex for the short length of time necessary for the complete combustion of the solid fuel under those conditions.

A Church-lighting Scheme.

The installation at the Dutch Reformed Church at Wellington, S.A., has some distinctive features.

WHAT is claimed to be the finest illuminated church in the Cape Province of South Africa is the Dutch Reformed Church of Wellington, which enjoys great renown owing to the fact that the distinguished preacher, Dr. Andrew Murray, used to occupy its pulpit. The interior, according to Mr. F. G. H. Louw, the architect, is described as "Classic Dutch," which, it will be noted, is designed without wealth of embellishment, the building being lofty, well ventilated, well lighted, and devoid of the usual architectural features common to places of worship. It excels, however, in its architectural lighting, which was installed by Mr. C. I. Evans, of Wellington. For this installation the whole of the wiring, cable, conduit tubing, switches, distribution boards, and lighting fittings were supplied by the British General Electric Co., Ltd. Gasfilled lamps are used exclusively, those in the main centre "Unalux" fitting, which is 24 in. in diameter, being of 500 watts in the centre bowl, surrounded by 100-watt lamps in the spherical "Equiluxo" bracket arm fittings projecting from the corona band. The remaining "Unalux" pendant units, which are 18 in. in diameter, are equipped with 300-watt lamps, while the 10-in. under-gallery fittings of similar pattern are equipped with 100-watt lamps. The organ lighting is contrived by a flexible standard with nickel-plated reflectors. The top of the church and the clock tower are illuminated very effectively by "Gecoray" silvered-glass lighting reflectors, which render the church visible at night from a considerable distance.

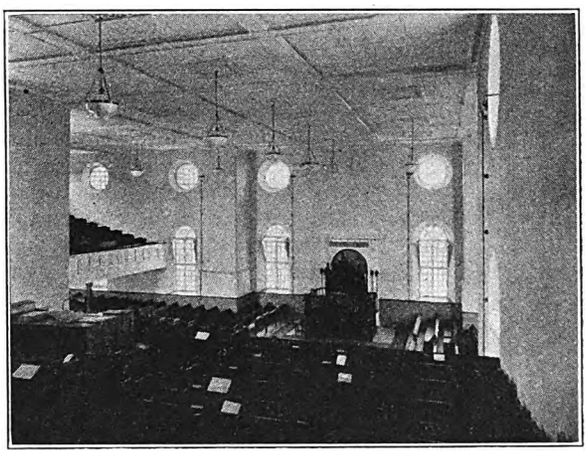

Fig. 1.—Daylight View in the Church.

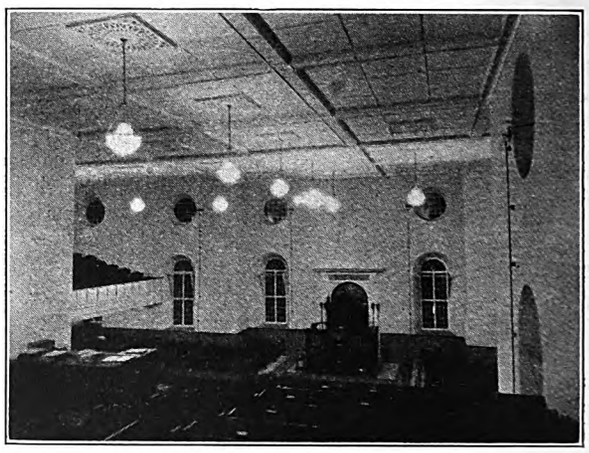

Fig. 2.—The Church Interior by Night.

One very remarkable characteristic of the illumination of this church—the intensity of which at pew level is of the order of nine foot-candles—is the very close approximation to actual daylight obtained from the lighting installation. Fig. 1 shows the lighting by African mid-day sunshine, while fig. 2 is an untouched night view of the interior by artificial lighting. As an example of enterprising overseas church lighting, this church can have few equals, and great credit redounds to all those concerned in the designing and carrying out of so praiseworthy an installation.

Electricity in Empire Coal Mines.

The British Empire Steel Corporation is making good headway with its programme for the substitution of electricity for steam in the operation of its coal mines. Its power plant on the southern side of Sydney Harbour has now been linked up with its Sydney steel plant, and a high-voltage line is being run in a submarine cable under and across the entrance to Sydney Harbour to connect the workings at Sydney mines with the power plant. At number IB. Colliery a large compressor, said to be the most modern of its kind, is to be installed.

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Parliamentary News.

[By Our Special Parliamentary Reporter.]

The Coal Mines Bill.

On December 19th, by 281 votes to 273, the House of Commons gave a second reading to the Coal Mines Bill. The debate on the measure lasted two days, and the Bill was very severely criticised. Many members considered that it would lead to dearer coal, especially for gas and electricity undertakings. Sir HERBERT SAMUEL, who was chairman of the 1925-26 Coal Commission, said that while the Minister of Transport during the previous week had rejected the policy of high prices, quick profits, and a quiet life with regard to electricity, his colleague, the President of the Board of Trade, in relation to the mining industry, was offering to the coal-owners that very policy.

The Government indicated, however, that it would consider amending the Bill in Committee.

Brookman's Park.

On December 17th, Sir WILLIAM MITCHELL-THOMSON asked the Postmaster-General if he would state what call-sign was being allocated to the second station at Brookman's Park; and when it was anticipated that a full alternative programme would be transmitted from that station.

Mr. LEES-SMITH said that it had been agreed that, for the time being, the London call sign "2LO," should cover both transmitters at the Brookman's Park station. When two programmes were transmitted simultaneously they would be referred to as "London Regional" and "London National," respectively. The tests which were now being carried out in the transmission of alternative programmes for short periods would be continued for some weeks; but the British Broadcasting Corporation was not yet able to state the date on which it expected to be in a position to transmit full alternative programmes from the station.

Overhead Telephone Wires.

On December 17th, Lieut.-Col. AINSWORTH asked the Postmaster-General if he would state in how many districts during the current year new poles and overhead wires had been erected in connection with telephone development work; in how many instances protests had been made against their erection by the local authorities concerned, on the grounds that they created a nuisance or detracted from the amenities of the district; on what conditions those protests were acceded to; and why, in view of the fact that it was the ultimate aim of his department to have all telephone wires underground, it was decided to erect them overhead in the first instance.

Mr. LEES-SMITH said that overhead lines had probably been constructed in practically all districts during the current year in connection with the development of local telephone services; a number of local authorities had made objections, on various grounds, but it was not possible, without a disproportionate expenditure of time and trouble, to furnish precise figures on either point. Underground cables were laid to the fullest possible extent consistent with economy, but a proportion of overhead wires was essential to the widespread development of the service unless altogether prohibitive expenditure was to be incurred.

Wireless Receiving Licences.

On December 17th, Mr. BENSON asked the Postmaster-General if he would state the cost of issuing a wireless receiving licence, and upon what basis the cost was calculated.

Mr. LEES-SMITH said that the average cost during the last financial year was about 1s. 1d. per licence. This cost was based upon returns of the time occupied, and it included provision not only for the issuing, recording, and renewing of annual licences, but also for headquarters work and for such duties as the detection of unlicensed stations and any subsequent legal proceedings.

The Channel Tunnel.

On December 17th, Mr. THOMAS, the Lord Privy Seal, informed Mr. Louis Smith that the Channel Tunnel Committee hoped to submit its report by the time that Parliament reassembled after the recess. There would be no delay on the part of the Government in considering the report. Additional facilities and technical assistance had already been placed at the disposal of the Committee.

L.N.E.R. Electrification.

On December 18th, Mr. EDE asked the Minister of Transport whether the London and North-Eastern Railway Company contemplated any extension of the electrification of its system to any of the lines in the county of Durham; and, if so, the mileage it was proposed to electrify and the towns that would be served by the electrified lines.

Mr. H. MORRISON said he was informed by the Railway Company that no electrification of its lines in the county of Durham was at present contemplated.

Special Orders.

Special Orders have been approved authorising the Farnham Gas & Electricity Company to raise additional capital for electricity purposes, and in respect of part of the rural district of Godstone, in the county of Surrey.

Cornish Electrical Development.

Some notes on an extensive overhead-line transmission and distribution system.

"Recent Electrical Development in the West" was the subject of a paper recently read by Mr. L. A. Hards, manager of the Cornwall Electric Power Company, before the Cornish Institute of Engineers at Camborne. He said that during the last two years his company's system of mains had been considerably increased. In west Cornwall alone no fewer than 33 towns and villages were supplied with electricity. A number had adopted electric street lighting, and there was a likelihood of a considerable extension in that direction. In addition, they now controlled supplies to a number of towns and villages in eastern Cornwall, including Saltash, Torpoint, Looe, Bodmin, Padstow, and Wadebridge; eventually the local plant at all those places would be shut down and they would be connected to a system of mains which would extend from one end of Cornwall to the other. It had been no easy matter to supply such a sparsely-populated area as Cornwall, and, though the cost of production was small, the cost of distribution was considerable for small quantities. They had, therefore, to keep the cost of distribution as low as possible, and the principal way of doing so was by the use of overhead mains. There had been great antagonism to that, which had tended to seriously impede the extension of the supply. On the one hand, engineers were doing their best to give the service which appeared to be required, and, on the other hand, the general public was doing its best to prevent them. When their early mains from Hayle to Carn Brea were constructed, they had to be considerably deviated and the line to the west, to Geevor and Botallack, had to go over the moors; had that not been the case they would have been supplying all the villages between Carn Brea and Penzance by this time. To supply them now would mean the construction of more mains. It was difficult to say what the future would be for them, but in the meantime they were doing their best to serve the area in the most economical way possible, by the use of the cheapest methods of transmission and local sub-stations. Electrical engineers certainly did not put up overhead mains for preference; they caused a good deal of trouble and were far more difficult to install. They had various authorities with whom they had to deal, and it was important that they should not interfere more than was absolutely necessary with the telegraph and Post Office services. It took far more time and trouble to lay out a system of mains overhead in a town or village than it did to lay mains underground. Unfortunately, the initial cost was so enormously greater in the case of underground mains that overhead mains were the only practicable method of providing supplies in scattered areas. Again, the service with an underground main was more reliable than it was with overhead wires. Quite recently Cornwall had suffered from some of the worst storms in their recollection; the velocity of the wind at Falmouth during the night of November 6th was 103 miles per hour, while at the Scillies the indicating needle went off the scale at 108 miles per hour, and from calculation they arrived at the figure of 112 miles per hour. During those storms a considerable amount of damage was done to their overhead system; it was, however, generally of a minor character, such as small displacements of the wires, the principal trouble being due to falling trees, but no poles carrying high-pressure wires were brought down. The staff had a very strenuous time, but the public suffered very little indeed in the way of loss of service. He, personally, expressed his appreciation of the way in which the Cornwall Electric Power Company's overhead lines staff stuck to duty during the very severe weather. The public was not generally in a position to know what that sort of work entailed.

Diesel Engine Users' Association.

A good number of members and visitors attended the December meeting of the Association to hear a paper on "A Form of Coupling for Geared Diesel Engines for Land and Marine Purposes," by Mr. W. Brose. The form of coupling described was developed in the Vulcan Yard, Hamburg, and is based on the patents of Dr. Bauer. It is claimed that it minimises torque fluctuations and permits splitting up the power of one large unit into two or more high-speed light units, whose small cylinders are much less sensitive to heat stresses. The device consists of hydraulic couplings with mechanical gearing, or of two wheels of cup-like section, one driving the other. The driving fluid is held in the cups of the wheels. There is no metallic connection between the wheels, and it is not essential for them to be exactly in line. The transmission of power is effected by the rotation of the driving wheel, which sets up a circulatory motion in the fluid between the two cups and thus sets the driven wheel in motion.

The driving efficiency is given as 97 per cent., and the coupling has the advantage of mechanical simplicity. The paper concluded with a description of specially designed gears for electric power stations, particularly for peak-load generators.

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Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

The " Electrical Review " Index.

The index to Vol. CV (for the half year ending December 31st, 1929) will be published shortly, and we shall be glad to receive the names and addresses of those who require it (free of charge) for binding purposes or wish to retain it for reference. Application should be made as early as possible to the Publisher, 4, Ludgate Hill, E.C.

E.D.A. Salesmanship Conference.

At the second of the series of E.D.A. Salesmanship Conferences held at the Manchester Lighting Service Bureau, Mr. R. C. Hawkins, the district officer, gave an interesting paper on the "Value of Exhibitions to the Electrical Industry," the chair being occupied by Mr. Romero, Salford City electrical engineer. Mr. Hawkins said that one of the day-to-day problems of electrical salesmanship was the question " Are exhibitions worth while?" Of the various types of exhibitions he proposed to deal mainly with the Ideal Home type, the general trade type, usually promoted by Chambers of Commerce, and local electrical exhibitions, usually organised by supply undertakings with the help of contractors. In the Ideal Home type they had a valuable means of publicity, but he warned them against the danger of filling up with " junk " and too much furniture. It was essential to have systematised propaganda. There should be a story to attract attention in every room. There was no doubt about the good resulting from the second type of exhibition, and he gave definite instances in which sales had immediately gone up. In spite of the large increase in the number of showrooms, the third type of exhibition was essential. In the small towns it was the best form of publicity. Summing up, Mr. Hawkins said that exhibitions had a special advantage over other forms of publicity, as the promoters were able to interest the Press and obtain extra publicity by that means. Local exhibitions should not be open for more than two weeks, and it was essential to have a good opening ceremony to attract the public from the beginning.

The Export Credits Guarantee Scheme.

The Committee, presided over by Sir Otto Niemeyer, G.B.E., appointed to consider generally the administration of the Export Credits Guarantee Scheme, has produced its final report. An interim report was published in April last, suggesting a form of commercial account for the Department. The final report contains the following recommendations:—(1) That the necessary legislative steps should be taken to extend to September 8th, 1934, the period during which facilities can be granted. (2) That the liquidation of the previous schemes should be transferred to another department. (3) That for the period July 1st, 1926, to March 31st 1928, and thereafter for every year ending March 31st, a commercial account on the lines recommended should be issued by the Export Credits Guarantee Department. (4) That an executive committee of three should be appointed immediately to have powers analogous to those of a board of directors, including the choice, appointment, and remuneration of staff. (5) That the Advisory Committee should continue to function generally on the lines on which it is at present assisting the Department.

United States Electrical Exports.

A further advance in exports of electrical goods and apparatus from the United States was recorded for September, the total value being $13,116,894, as compared with $7,400,973 in September, 1928. This large increase was a general one, there being only a few small decreases. The principal rises occurred in the following classes:—Radio apparatus, from $1,197,248 to $2,627,836; refrigerators up to one-ton capacity, from $467,513 to $842,359; telephone apparatus, from $173,962 to $612,472; storage batteries, from $199,949 to $320,111; stationary motors from 1 to 200 h.p., from $210,993 to $381,378; fractional h.p. motors, from $184,266 to $279,609; d.c. generators, from $57,474 to $155,018; a.c. generators, from $12,576 to $164,845; and bare copper wire, from $92,337 to $348,687. The United Kingdom was the greatest purchaser of the last class of goods, its share amounting to $113,544. Altogether the United Kingdom imported United States electrical goods valued at $813,537 (an increase of $531,311) during September. The bulk of the shipments included fractional h.p. motors, portable electric tools, accessories and parts for motors, radio components and loud speakers, bare and insulated copper wire and cable, refrigerators and other motor-driven household appliances. Canada's share of the trade was valued at $4,106,578. Other important customers were:—Australia ($746,531), Argentina ($603,512), Mexico ($608,274), Chile ($499,375) and Brazil ($482,697). America's electrical imports during September had a value of only $232,302.

International Combustion Engineering Corporation.

Press reports from New York state that on the petition of the Bethlehem Steel Corporation, the Courts appointed a temporary receiver for the International Combustion Engineering Corporation on December 19th. Though this had been expected for some time in well-informed quarters, the stock fell on that day from 10⅞ to 6, and the whole of the stock market was shaken. The *Financial Times* correspondent says that the stock advanced last year from 45¼ to 80 and to 103½ in February this year, despite the fact that only 75 cents a share was earned last year over and above the $2 dividend. The writer says: " The idea of using waste pulverised coal for fuel was a good one, but the company was over-capitalised, over-extended, and over-manipulated in the stock market." The *Central News* quotes the president of the company as stating that a prompt reorganisation will be effected, thus preserving the value of the properties and goodwill and earning power of the company. The *Financial Times* says that the company controls, directly or indirectly, 29 domestic and foreign subsidiaries, including, in England, the Underfeed Stoker Co. and International Combustion, Ltd. The New York correspondent of *The Times* reports that receivers in equity have also been appointed for two American subsidiaries—the Combustion Engineering Corporation, New York, and the International Combustion Tar & Chemical Corporation, Illinois.

Italian Foreign Electrical Trade.

The appended table shows the Italian imports and exports of electrical machinery and apparatus during the first nine months of the current year, as compared with the corresponding period of 1928. The values have been converted to sterling at an exchange rate of 93 lire to the £. It will be seen that both imports and exports show an increase, the former of £423,430 and the latter of £167,020.

	Imports. Janry. to Septr.		Exports. Janry. to Septr.	
	1928	1928	1928	1928
	£	£	£	£
Accumulators & parts	23,000	47,660	31,190	14,330
Incandescent lamp bulbs	24,340	37,180	—	30
Electrical measuring instruments ...	28,060	45,880	690	2,010
Electrical apparatus miscellaneous ...	600,100	583,480	79,370	108,030
Telegraph, telephone and radio apparatus	659,790	1,072,020	79,970	20,130
Electric furnace and other carbons ...	110,250	132,580	4,040	3,240
Insulated cables ...	27,700	16,420	136,670	158,620
Generators " without collectors "	178,020	169,400	11,290	30,990
Generators " with collectors "	179,330	214,290	171,760	255,500
Glass and porcelain insulators	22,640	19,400	10,800	13,290
Arc lamps	430	480	—	150
Incandescent lamps ...	312,410	252,060	48,490	71,940
Static transformers ...	42,930	64,560	6,770	13,140
Insulating tubes ...	1,870	4,270	2,310	1,590
Electricity meters ...	94,090	72,330	1,950	3,340
Insulated wire	25,320	21,700	38,150	44,140
Totals	£2,330,280	£2,753,710	£563,450	£730,470

Automobile Accessories for Australia.

The Senior Trade Commissioner in Australia (Mr. R. W. Dalton, C.M.G.) reports that a new company is in process of formation for the construction of motor cars in Australia, and is desirous of receiving quotations for motor-car engines, instruments, electrical equipment, &c. Firms desirous of offering components or equipment of British manufacture can obtain further particulars on application to the Department of Overseas Trade, 35, Old Queen Street, S.W.1. (Reference No. A.X. 8921.)

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New Municipal Showrooms and Offices.

The Heston and Isleworth Urban District Council has taken a further step to promote the domestic use of electricity, by erecting new showrooms and offices which were inaugurated on December 18th by Sir John Ferguson, M.P. The building occupies a site with two frontages, one to the Staines Road, and the other to the Bath Road, each having a width of 40 ft., providing excellent facilities for the display of apparatus. The ground floor includes a spacious showroom and offices. The design of the showroom and colour scheme have been arranged so as not to detract from the appearance of the exhibits, and the fittings have also been designed to conform with the general scheme, the show cases being equipped with concealed lighting. The first floor includes a general office, private offices, and drawing office, and two large rooms allocated and fitted up for meter testing and repairs. The entrance portal of the showroom, together with the display windows on either side, is carried out entirely in bronze, toned to a special tint to harmonise with the general internal effect. The building is electrically heated throughout. At the opening ceremony Mr. H. J. Nias, in introducing Sir John Ferguson, said that during the past five years rapid progress had been made, and the number of consumers had increased by 6,000, to over 9,000. The showrooms were not intended to compete with local contractors, but to serve as an advertisement of the electricity undertaking. The General Electric Co., Ltd., assisted the Council in arranging the display of apparatus for the opening ceremony.

Unemployment.

The number of registered unemployed increased by 6,570 during the week ended December 9th. At that date the total was 1,309,500, as compared with 1,302,930 on December 2nd, and 1,320,912 on December 10th, 1928.

Employment in November.

During November, reports the *Ministry of Labour Gazette*, employment in the engineering industry was still slack and, taken as a whole, showed no change as compared with the preceding month. In electrical engineering the employment continued fairly good. The number of unemployed in the engineering industry rose from 90,536 in October to 90,594, the proportion remaining at 9.0 per cent. In the electrical branch there was a rise from 3,462 to 3,583 in the number of unemployed, *i.e.*, from 4.1 to 4.2 per cent. The electric cable, wire, and lamp manufacturing group reported increased unemployment, the number rising from 3,791 to 4,214 (from 4.0 to 4.5 per cent.). In the electrical wiring and contracting industry there was a rise in the number of unemployed from 1,047 to 1,223 (from 6.3 to 7.4 per cent.).

New Italian Companies.

Among the companies recently formed in Italy are the Società Passioni e Villa, Fabbrica Isolatori e Condensatori, Milan, capital 1,000,000 lire; La Società Elettrica Alto Sangro, Rome, capital 1,500,000 lire; and La Società Struttamenti Idroelettrici, Rome.

Czecho-Slovakian Electrical Imports.

During October last the value of electrical machinery and tools imported into Czecho-Slovakia was 30,000,000 crowns (about £180,000), bringing up the total for the first ten months to 282,000,000 crowns (£1,700,000) as compared with 195,000,000 crowns (£1,180,000) in January-October, 1928.

Proposed Greek Lamp Factory.

A report published in Amsterdam from Athens says that the Philips Glow Lamp Works proposes to establish a subsidiary company in Greece. The new company, which is to have a share capital of 10,000,000 drachmae, is to produce 5,000 lamps per day, and the factory is to be erected in the vicinity of Athens.

The Electrical Trade Protection Association.

At a meeting of Birmingham electrical manufacturers and factors called by the British Electrical Trade Protection Association on December 3rd., it was announced that local secretaries of the Association had been appointed for the Leeds, Manchester and Bristol districts and, as a result of the meeting, it was decided to appoint local secretaries in the Birmingham district. The secretaries of the Association are Messrs. McMillan & Henderson, 5, High Holborn, W.C.1, and 13, Dundas Street, Glasgow.

Radio Imports into Venezuela.

An Executive Decree annuls the law prohibiting the importation into Venezuela of radio apparatus, and hereafter permits free entry provided application is filed with the Ministerio de Fomento and special permits are obtained to cover each importation.—*Reuter's Trade Service* (Caracas).

An Electricity Committee Censured.

The New Mill (near Hudderfield) Urban District Council, on December 18th, passed a vote of censure on its own Electricity Committee for having appointed a successor to the lately-resigned electrical engineer without consulting the Council as a whole. The matter arose because the Yorkshire Electric Power Co., on learning of the resignation, made an offer to take over the local electricity undertaking. The Electricity Committee rejected the offer and appointed a new local engineer. It was resolved that the Committee should not take definite action in future without the sanction of the Council as a whole.

E.T.U. to Move to London.

It is reported that the Electrical Trades Union is preparing to transfer its headquarters from Manchester to London. Negotiations are proceeding for the acquisition of a building in the Clapham district

Esthonian Water-power Contract.

The *Financial News* reports that after negotiations lasting several years a provisional contract for the exploitation of the Narva waterfalls was signed at Reval on December 22nd between the Esthonian Ministry of Trade and an English company—the International Hydro-Electric Syndicate. The syndicate is to receive a concession for the establishment of a 50,000-kW power station, the cost of erection being estimated at 30,000,000 kroner. During the negotiations the syndicate has been competing with a German banking company and another bank in San Francisco, and against the Siemens-Schuckert Co.

A Schoolboys' Exhibition.

The Hon. Esmond Harmsworth will open on December 31st a Schoolboys' Exhibition organised by the *Daily Mail*, at the Horticultural Hall, Westminster, S.W.1. The London County Council Education Department will present a number of interesting exhibits, including working models of electric trains, &c. There will also be exhibits of model engines of both stationary and marine types, petrol or electrically driven. The exhibition will remain open until January 8th, and the tickets of admission, which take the form of a Christmas card, can be obtained from "Christmas Cards," Schoolboys' Exhibition, *Daily Mail*, Carmelite House, E.C.4, at 2s. each.

Visits of British Trade Representatives.

The Department of Overseas Trade informs us that Mr. H. O. Chalkley, C.B.E., Commercial Counsellor at the Buenos Aires Embassy, will attend at the offices of the Department from January 13th to 17th, and from February 3rd to 7th to interview manufacturers and merchants interested in the exports of British goods to Argentina. He will also visit a number of provincial industrial centres. Intefviews can be arranged by, or information obtained from, the D.O.T., 35, Old Queen Street, S.W.1. (Reference 5534/1/29.)

The Department also states that Mr. H. J. Brett, C.M.G., Commercial Secretary at Shanghai, will be available at its offices from January 16th to 24th. He will also pay visits to industrial centres, and the reference which should be quoted by those desiring interviews is 2203/1/29.

The G.E.C. in 1929.

The GENERAL ELECTRIC CO., LTD., has sent us a review of its activities during the year which is now closing. This shows that the company has continued its progress in a number of diverse directions. Particular mention is made of the contracts received for the Central Electricity Board in connection with the national scheme; the large turbo-generators and other plant for the Hams Hall (Birmingham) power station; the 1,500-V equipment for the electrification of the Manchester-Altrincham line; the lighting of the Thames Embankment; and many other home contracts. Some details of important overseas contracts are included, among these being a large 11,000-V switchgear order from the Pretoria Municipality; mining electrical plant for South Africa; e.h.p. outdoor sub-station equipment for New Zealand; hydro-electric plant for Palestine; motor coach equipments for the new Buenos Aires tube railway; tramway equipments for Auckland, N.Z.; and Diesel-electric locomotives for India. Steady progress has been made in the Illuminating Engineering Department, and many notable contracts, home and overseas, have been carried out with the company's equipment. Further headway has also been made in the direction of household appliances and cookers. A list is given of large installations of "Magnet" industrial cooking and baking ovens. Reference is also made to advances in connection with electric furnaces, wires and cables, marine electrical equipment, radio sets and valves, and bakelite accessories, and the activities of the Research Laboratories at Wembley are dealt with.

Cardiff Corporation and Contractors.

The *Western Mail* reports that at last week's meeting of the Cardiff City Council, the Electricity Committee reported breaches of contract by the Glamorgan Electricity Company, in that the firm had sub-let work allotted to it under the Corporation's scheme of extensions. A trade union had lodged complaints that the fair-wages clause in the contract had been violated by the employment of non-union men at low rates. Mr. C. G. Morley New, city electrical engineer, said that contractors had been warned that sub-letting was not permissible, and the Glamorgan Electricity Company had undertaken not to do so. Further complaints had been received, however, and it was found that a number of contracts had been sub-let. A representative of the firm expressed regret, and said that his excuse for the breaches of contract was the heavy cost of canvassing for orders. The Council decided that the firm should be suspended from the contractors' list for a period of twelve months.

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Australian Tariff Amendments.

The *Board of Trade Journal* for December 19th reported further alterations in the Australian Customs tariff. Among the classes of goods affected are electrical fittings, consisting wholly or partly of metal, *viz.*, switches, fuses and lightning arrestors, n.e.i.; regulating, starting, and controlling apparatus for all electrical purposes, including distribution boards and switchboards, n.e.i.; dynamo-electric machines; static transformers; rectifiers; ironclad or moulded switches and fuses; and dry batteries. In every case the alteration represents an increase in duty.

The Indian Government's Purchasing Policy.

In the new stores purchase rules based on the rupee tender system promulgated on December 14th, the Government of India explains that its policy is to make purchases of stores in such a way as to encourage the development of Indian industries to the utmost possible extent consistent with economy and efficiency. Preference will be given in the following order:—(1) To articles purchased in India in the form of raw materials or manufactured in India from Indian raw material, provided the quality is sufficiently good. (2) To articles wholly or partially manufactured in India from imported articles, provided the quality is sufficiently good. (3) To articles of foreign manufacture stocked in India, provided they are of suitable type and of the requisite quality. (4) To articles manufactured abroad which need to be specially imported. The purchasing authority when satisfied that such a measure is justified, may allow a limited degree of preference in respect of price to articles produced and manufactured in India, either wholly or partly. All articles specified, except military stores, or of a special or unusual character, shall be purchased with the condition that delivery be made in India and payment made in rupees in India. Tenders will be invited in India and also abroad when desirable, but delivery must be made in India and payment must be made in rupees.

The rules provide that technical apparatus and equipment and other stores for which drawings, patterns, specifications and designs are issued by the authorities, will be indented by the India Store Department in London unless available in India. The articles of a special or unusual character which can be purchased through the agency of the India Store Department, London, or direct from the manufacturers, include scientific instruments.

These rules come into operation on January 1st, 1931. Meanwhile, the Government directs that purchases be made in accordance with these rules whenever convenient.—*Reuter* (New Delhi).

Book Notices.

"Grit Emission and the Remedy."—A treatise on atmospheric pollution by W. A. Smith. This publication of Pneumatic Conveyance & Extraction (1929), Ltd., treats the subject in its broad sense, in a very interesting manner; it is well illustrated.

The *Mechanical World* Electrical Pocket Book, 1929. Pp. 338; fully illustrated. Manchester: Emmott & Co., Ltd. Price 1s. 6d. net. It is unnecessary to say much in introducing the new edition of this useful little pocket book. It maintains its past high standard, and a large amount of new matter is to be found in its pages, particularly relating to heavy electrical engineering.

Publications of the Association of Engineering & Shipbuilding Draughtsmen. Graphical statistics. By E. N. Digweed, Wh.Ex., G.I.Mech.E. Price 2s. net.

The *Practical Engineer* Electrical Pocket Book & Diary, 1930. London: Oxford University Press. Price 2s. 6d. or 3s. according to binding. A careful revision has been made of the contents of this valuable publication, so as to keep this new edition down to dimensions commensurable with its use as a pocket book. The section relating to lighting has been re-arranged, and the tables of Wiring Regulations of the Institution of Electrical Engineers have been transferred to the section to which they are more appropriate.

"*Journal* of the Institution of Electrical Engineers." Vol. LXVIII, December, 1929, No. 396. Also list of subscribers and donors to the Institution of Electrical Engineers' Benevolent Fund for the twelve months ended September 30th, 1929, London: E. & F. N. Spon, Ltd. Price 10s. 6d.

Social Events.

The annual supper and dance of the staff of the Lothians Electric Power Co. was held at Macvittie's Guest's Restaurant, Princes Street, Edinburgh, on December 12th. Mr. H. C. Babb, general manager, presiding. In proposing the toast of "Our Guests," Mr. Babb said that of late the company had done more advertising than in the past, which might account for the very busy time experienced during recent months. Mr. G. Seddon, general manager of Edinburgh Corporation Electricity Department, responded.

A successful dance was held at Magnet House, Kingsway, W.C.2, on November 26th under the auspices of the G.E.C. Social and Athletic Club, netball and rowing sections.

Private Arrangement.

A. B. WAKELING, 558, Beverley High Road, Hull.—Mr. W. Brian Hall, National Provincial Chambers, Silver Street, Hull, the trustee under a deed of arrangement, informs us that a first and final dividend of 3s. 9d. in the £ is being paid to unsecured creditors.

Lighting a Fruiterers' Window.

The accompanying illustration depicts an excellent example of shop-window lighting in connection with a difficult subject. The window is that of Amalgamated Fruiterers,

An Illuminated Fruit Display.

Ltd., Southampton Row, W.C.1. The equipment employed comprises G.E.C. interior and window-lighting units utilising "Gecoray" reflectors. The way in which every item in the display receives its share of the illumination is very remarkable.

The British Honduras Tariff.

The duties upon electrical apparatus other than machinery imported into British Honduras have been altered to 10 per cent. *ad valorem* under the British preferential tariff and 20 per cent. under the general tariff.

Dissolutions of Partnership.

ASHELL & Co., automobile electrical engineers and Exide battery service agents, Yorkshire Street, Bacup.—Mr. H. Ashworth and Mr. T. Mitchell have dissolved partnership. Mr. Ashworth will attend to debts and continue the business under the same style.

WEIR ENGINEERING Co., general mechanical, motor boat, and electrical engineers, Hamble, Southampton.—Mr. H. L. D. Fordyce and Mr. J. R. M. Stanfield have dissolved partnership. Mr. Stanfield will attend to debts.

Bankruptcy Proceedings.

RICHARD GREEN, formerly trading as Fleet Radio Stores, 143-144, Fleet Street, E.C.—An application was made last week to Mr. Registrar Warmington at the London Bankruptcy Court for an order of discharge on behalf of this bankrupt, who failed in May, 1929. The Official Receiver reported that the provable claims amounted to £9,055; the assets had produced £5,540 and a further £4,125 was expected, making a total realisation of £9,665, from which dividends in excess of 10s. in the £ would be paid. The applicant formerly carried on business as a dealer in photographic stores; in 1922 he obtained a seven years' lease of premises at 143-144, Fleet Street, at a rental of £850 per annum, and there traded as Fleet Radio Stores. City Sale & Exchange, Ltd., was formed in November, 1923, when the bankrupt was trading at seven addresses in London, and he was appointed managing director, at a salary of £2,000 per annum. He more or less relinquished control of the business after the company was formed, and owing, as he alleged, to subsequent mis-management, the company went into voluntary liquidation in April, 1929. The debtor attributed his failure to liability under guarantees given by him on behalf of the company, and to losses owing to bad trade. His Honour granted the discharge subject to a nominal suspension of one month.

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H. GASCOIGNE, 40, Cricklade Street, Cirencester, Glos., wireless dealer, &c.—The public examination herein was held on December 18th at the County Court Buildings, Swindon, when a statement of affairs was filed showing gross liabilities of £746, against assets of £138. It appeared that the debtor was out of employment for ten months after being demobilised, and he then obtained a situation but left to go into partnership. He subsequently bought his partner out, but he soon became aware that the business was not a success, and he got into financial difficulties after a three months' illness. It was reported that the debtor's books had been kept satisfactorily. The hearing was adjourned for closing.

E. W. BLAIR (Blair & Son), electrical engineer and contractor, 6, Queen's Parade, Brent Street, Hendon.—Last day for proofs for dividend, January 2nd. Trustee, Mr. T. Gourlay, Official Receiver, 29, Russell Square, W.C.

T. E. WOODHEAD, electrical factor, 26, Central Drive, Blackpool.—Last day for proofs for dividend, January 2nd. Trustee, Mr. H. Parker, Official Receiver, 9, Cannon Street, Preston.

R. R. WRIGHT (Wright Bros.), wireless dealer, 36, Normanton Road, Derby.—Last day for proofs for dividend, January 3rd. Trustee, Mr. L. A. West, Official Receiver, 22, Regent Street, Park Row, Nottingham.

F. PRICE and C. R. TARVER (F. Price, Tarver & Co.), electrical engineers, 15, Working Street, Cardiff.—First and final dividend of 1s. 6½d. in the £, payable December 24th, at the Official Receiver's office, 34, Park Place, Cardiff.

Company Liquidations.

STANDARD PLATINUM CONTACTS, LTD., 121-123, Shaftesbury Avenue, W.C.—Under a compulsory winding up order made against this company on November 18th upon a creditors' petition, the statutory first meetings of the creditors and shareholders were held on December 13th, at the Board of Trade Offices, Carey Street, W.C. Mr. Naunton, Official Receiver, reported that the company was formed as a private company on August 22nd, 1927, with a nominal capital of £5,000, to carry on business as manufacturers of platinum contacts, magneto parts and engine valves. It was promoted by C. E. Taroni, who started business in August, 1926, under the name of Standard Platinum Screw Co., at Mortimer Street, W. The concern was financed throughout by Taroni, and the trade resulted in a gross profit but a net loss. The failure was attributed to inefficient management and heavy liability of the company in connection with the lease of the premises. A statement of affairs had been lodged, showing liabilities of £2,774 and a deficiency of £5,661 with regard to contributories, the issued capital being £3,499. The liquidation was left in the hands of the Official Receiver.

NIGERIAN POWER & TIN FIELDS, LTD.—Winding up voluntarily for amalgamation purposes. Liquidator, Mr. S. Hutchinson, Finsbury Pavement House, Moorgate, E.C.2, who is authorised to enter into an arrangement with a new company to be formed for the sale to it of the undertaking and assets of the company, &c., in accordance with the terms of the scheme for amalgamation.

Trade Announcements.

The RADIO SUPPLY CO., Wood Street, Northampton, has opened a stockroom at 43, Queen Street, Peterborough.

During the greater part of last week Messrs. MARSHALL AND LUPTON, LTD., 14, Davies Street, W.1, held a special exhibition of modern electric lighting devices designed by Mr. J. B. Gold, architect.

Mr. W. D. SNAPE informs us that he has taken over the business of L. Andrew & Co., 2, Whitworth Street West, Deansgate, Manchester, and will carry it on under the same style.

The "Gleam" fuse-wire holder, a handy device designed by Mr. James Duncanson, which was described in our issue of September 10th, 1926 (p. 441), has been improved and is now marketed as the "New Series Quick Service" fuse-holder by the D. F. M. MANUFACTURING CO., LTD., 29, Waterloo Street, Glasgow, of which Mr. Duncanson is manager.

Messrs. SIEMENS BROS. & CO., LTD., have made arrangements to transfer, as from January 1st, their Pyrometer and Temperature Measurement Department to their associated company, Elliott Brothers (London), Ltd. The technical and commercial staff which has been dealing with these matters is being transferred to Lewisham, together with all stocks of apparatus, records, drawings, and patterns. Inquiries and correspondence on temperature measurement matters should be addressed to: Elliott Brothers (London), Ltd., Century Works, Lewisham, S.E.13.

The offices of the ASSOCIATED AUTOMATIC MACHINE CORPORATION, LTD., and its subsidiaries have been removed to 14, Appold Street, E.C.

Messrs. GRIFFIN, HARDING & BRYANT, LTD., electrical contractors and wireless engineers, have opened new showroom premises at 1, Park Lane, Swindon.

Messrs. HOGAN & WARDROP have removed from Golden Lane to 25, Old Street, E.C.1.

The new address of Mr. VIVIAN E. WILLIAMS is 70, Finsbury Pavement, E.C.2.

Recent Contracts.

The Hackney Electricity Committee recommends the acceptance of the tender submitted by Messrs. SIMON-CARVES, LTD., Manchester, for the additions to the boiler plant at the Millfields Road generating station. The contract comprises the installation of three water-tube boilers, each having an evaporative capacity of 125,000 to 150,000 lb. of steam per hour, travelling grate mechanical stokers, economisers, superheaters, mechanical draught plant, and an independent chimney to each boiler. The contract also includes the whole of the foundations and civil engineering work, a new steel-framed brick boiler-house capable of accommodating six of these boilers, and coal-handling and storage plant of sufficient capacity to deal with the full line of boilers. The total value of the boiler plant contract is in the neighbourhood of £250,000. The boilers will be of the Simon-Carves multiple-drum type with water-wall combustion chambers and water-cooled stoker arches, fired by travelling-grate mechanical stokers. Ashes will be removed from the boilers by sluicing to an underground pit, from which they will be transferred by electrically-operated grabs to an overhead bunker for delivery to barges. The coal-handling plant will comprise electrically-driven transporters arranged for unloading coal by means of grabs from barges, and weighing and transporting it to overhead storage bunkers in the boiler house or to a large storage yard at the rear of the station. The boiler-house bunkers will have a storage capacity of 2,000 tons of coal. A new central control room for the boiler plant, a laboratory, and mess rooms for the staff are included in the contract. The new plant forms part of a large extension which is to be carried out at the station under the national electricity scheme.

Messrs. RUSTON & HORNSBY, LTD., have recently received an order for nine "Ruston" marine auxiliary oil-engine generating sets, each of 306 kW. These will be installed (three sets per vessel) on board three motor cargo liners to be built for the New Zealand Shipping Co., Ltd. Two of the vessels will be built by Alexander Stephen & Sons, Ltd., Govan, Glasgow, and the other by Vickers-Armstrongs, Ltd., Barrow-in-Furness. Each auxiliary engine will be a five-cylinder unit working on the "Ruston" principle of airless injection and capable of developing 450 b.h.p. at 270 r.p.m., or 500 b.h.p. at 300 r.p.m. and each will drive a d.c. dynamo supplied by the GENERAL ELECTRIC CO., LTD.

The PARSONS OIL ENGINE CO., LTD., Southampton, has received an order from the Sunderland Echo Co., Ltd., for one of its new high-power generating sets for installation in the Echo Company's offices as a stand-by supply. The engine is of the company's latest pattern, having six cylinders, 7 in. bore by 8 in. stroke, and running at 1,000 r.p.m. on petrol fuel. The generator and exciter will be supplied by Messrs. J. H. HOLMES & CO., LTD., and will be capable of a continuous output of 125 kVA.

The airship "R.100," which is now undergoing its trials, has been provided with specially designed electrical cable and equipment. The complete wiring installation of the airship, including the lighting, heating, wireless cabins, and power control cars, has been carried out to suit the special conditions by Messrs. W. J. FURSE & CO., LTD. This company has also provided lightning conductors for the protection of the sheds in various parts of the world where airships of this type are to be eventually housed, including one recently erected at Karachi, India.

Calendars and Diaries.

The MULLARD WIRELESS SERVICE CO., LTD., Denmark Street, W.C.2, has again adopted a large representation of a radio valve for its calendar. This time the young lady is of a very modest type. A block of daily slips is provided.

"Appointments for 1930" is the modest title of an elaborately-produced diary received from the UNDERGROUND ELECTRIC RAILWAYS CO. OF LONDON, LTD., 55, Broadway, Westminster, S.W.1. It commemorates the centenary of the London 'bus and contains many excellent pictures of 'buses and various phases of London's transport system.

BRITISH BROWN BOVERI, LTD., London, has sent us a very handsome wall calendar comprising twelve monthly sheets each of which bears a beautiful photographic view of Swiss scenery. Several of these show railway and other work carried out by the Brown Boveri organisation.

Beautifully-coloured views of places within the company's area form the subjects of a calendar received from the NORTH METROPOLITAN ELECTRIC POWER SUPPLY CO.

From Mr. FERNAND ESPIR, 86-88, Queen Victoria Street, E.C.4, we have received a refill for a desk memoranda tablet, with dates and reminders.

A neat oxidised-silver desk device with a calendar-memoranda tablet has arrived from the SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.2.

Messrs. J. SHAW, SON & GREENHALGH, LTD., Huddersfield, have issued a serviceable wall calendar for 1930 with bold-figure daily slips.

Large date slips are also a feature of the 1930 calendar of Messrs. H. & C. DAVIS & CO., LTD., 1, The Pavement, Clapham Common, S.W.4. A special date-marking device is provided.

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The appropriate subject of a calendar received from the COMBUSTION STEAM GENERATOR, LTD., 1, Southampton Row, W.C.1, is the youthful James Watt and the historic kettle.

The 1930 calendar of Messrs. C. A. PARSONS & Co., LTD., Heaton Works, Newcastle-on-Tyne, comprises a set of large monthly cards bearing illustrations of some of the company's productions.

An Oriental beauty reclining in "The Garden of Allah" forms the subject of the illustration upon the 1930 calendar sent us by Mr. W. H. SQUIRE, 31, Sweyne Avenue, Southend-on-Sea.

Once again we have to acknowledge receipt of a copy of our welcome companion, the diary of Messrs. SIMPLEX CONDUITS, LTD., of Garrison Lane, Birmingham. For its size it gives a very generous space for engagements and memoranda.

A serviceable wall calendar with large daily slips has been sent to us by Messrs. LINDSAY & WILLIAMS, LTD., Manchester.

A very neat blotter-diary for 1930 has reached us from the ENFIELD CABLE WORKS, LTD., 296-302, High Holborn, W.C.1. There is a writing pad in the centre, and at the sides are a pocket and a diary with weekly pages. The sides fold over to enclose the pad. The company has also sent us a business-like calendar. This has monthly date sheets which display the preceding and succeeding months. An illustration of the company's "H"-type cable appears.

The calendar sent us by Mr. L. W. FOOTE, 30, Charles Street, Cardiff, is, as usual, a very attractive one. It bears a charming picture of "Cinderella" on silk, and monthly date slips.

The German SIEMENS concerns have sent us a neatly and strongly bound diary including details of the organisation and a view of Siemensstadt, Berlin. There is also a separate memoranda book.

The little brunette of the METRO-VICK SUPPLIES calendar who has cheered us during 1929, now gives place to a charming blonde at her toilette, also drawn by Mr. Bert Thomas. A "Boldefigger" daily pad is provided.

"The Secret" forms the subject of the 1930 calendar of the CHLORIDE ELECTRICAL STORAGE CO., LTD., Clifton Junction, near Manchester. This is an artistic reproduction in colour of a new "Exide" poster picture by John May.

A bold-figured daily pad in a business-like setting comes from Messrs. T. J. GRAINGER & Co., LTD., 20, Eldon Square, Newcastle-on-Tyne.

In addition to a refill for its desk calendar, BRITISH INSULATED CABLES, LTD., Prescot, Lancs., has sent us two wall callendars. These are of a novel character. In the centre are monthly date sheets, and on either side of this are slips showing the preceding and succeeding months. Similarly there are small insets giving the past, current and coming years' dates.

The 1930 calendar of Messrs. HILDICK & HILDICK, Walsall, consists of a representation of a bunch of screwed tubes bearing a pad of daily slips.

New Catalogues and Lists.

ELECTRICAL EQUIPMENT & CARBON CO., LTD., 107-109-111, New Oxford Street, W.C.1.—Price list No. M.17, giving illustrated particulars of "Elin" mercury rectifiers. Also a leaflet drawing attention to the "Mignon" electric hand drilling machine.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—Publication No. 7,977/7, entitled "Electrification Work for Overseas Railways," describing electric railway installations carried out by the company in Africa, America, Asia, Australia, and Europe. Some excellent illustrations are included.

VENECO, LTD., 55, Neal Street, W.C.2.—A well-produced catalogue of stage-lighting equipment, lamp shades, fires, chandeliers, &c. Illustrated and priced.

Messrs. HEYES & Co., LTD., Water Hayes Electrical Works, Wigan.—The first number of the *Wigan Review* contains an interesting historical article on the Wigan coat of arms, and notes on some of the company's lighting fittings.

HIGGS MOTORS, Witton, Birmingham.—A stock list of the company's a.c. and d.c. motors.

BROOKHIRST SWITCHGEAR, LTD., Northgate Works, Chester.—A pamphlet containing some notes on automatic control for a.c. motors, with particular reference to the company's products.

Messrs. W. E. BEARDSALL & Co., LTD., 5, Victoria Bridge, Manchester.—Two leaflets illustrating in colour the company's lighting fittings. Dimensions and prices are included.

RUNBAKEN MOTOR & ELECTRICAL ACCESSORIES, LTD., Magneto Works, Manchester.—Catalogue for 1930 of Runbaken accessories, giving brief particulars, prices, &c. Illustrated.

GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—The "Osram-G.E.C. Bulletin" for December contains a number of interesting articles on lighting installations carried out by the company, and notes on its activities.

SADIA, LTD., 22, Newman Street, W.1.—List No. H.S.2, describing Sadia automatic electric water heaters, including illustrations, dimensions, capacities, prices, &c. The cover illustration is in colour and shows a lady turning on the bath tap fed by one of the company's water heaters.

Messrs. HICK, HARGREAVES & Co., LTD., Soho Iron Works, Bolton.—A descriptive pamphlet of the company's closed-feed system.

E.D.A. Annual Meeting.

The annual meeting of the British Electrical Development Association will be held at the Savoy Hotel on Friday, March 21st, 1930.

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.	Price Dec. 23rd.	Fortnight's inc. or dec.
a	Acid, Oxalic ... ... per lb.	5¾d.	...
a	Ammoniac, Sal ... ... per ton	£60	...
a	Ammonia, Muriate (large crystal) ,,	£52	...
a	Bisulphide of Carbon ... ... ,,	...	...
a	Borax ... ... ,,	£25	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... ... per lb.	8d. to 4d.	...
a	,, Perchlorate ... ... ,,	5½d.	...
a	Shellac ... ... per cwt.	£13 10s.	...
a	Sulphur, Commercial ... ... ,,	£11	...
a	,, Roll ... ... ,,	£11	...
a	Soda, Chlorate ... ... per lb.	3d.	...
a	,, Crystals ... ... per ton	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	8⅝d.	...
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton	£95 to £100	...
b	,, Wire ... ... per lb.	1/1 to 1/9	...
b	,, Sheet ... ... ,,	1/1 to 2/9	...
p	Babbitts Metal and Anti-friction Metals—		
	Grade I ... ... per ton net	£168	£3 inc.
	Grade II... ... ... ,, ,,	£118	£3 inc.
	Grade III ... ... ,, ,,	£66	...
c	Brass (rolled metal 2" to 12" basis) per lb.	10⅝d.	...
c	,, Tubes (solid drawn) ... ,,	1/0⅜ to 1/1	...
c	,, Wire, basis ... ... ,,	10½d.	...
c	Copper Tubes (solid drawn) ... ,,	1/8	...
g	,, Bars (best selected) ... per ton	£110	...
g	,, Sheet ... ... ,,	£110	...
g	,, Rod ... ... ,,	£110	...
d	,, (Electrolytic) Bars ... ,,	£84	...
d	,, ,, Sheets ... ,,	£143 10s.	...
d	,, ,, Wire Rods ,,	£90	...
d	,, ,, H.C. Wire per lb.	11⅝d.	...
f	Ebonite Rod... ... ... ,,	2/3 to 2/6	...
f	,, Sheet ... ... ,,	2/3 to 2/6	...
n	German Silver Wire ... ... ,,	2/2	...
h	Gutta-percha, fine ... ... ,,	nom.	...
h	India-rubber, Para fine ... ... ,,	8¼d.	¼d. dec.
i	Iron, Pig (Cleveland No. 3.) ... per ton	72/6	6d. inc.
l	,, Wire, galv. No. 8. P.O. qual. ,,	£20	...
g	Lead, English pig ... ... ,,	£23 5s.	10/- inc.
g	Mercury ... ... per bot.	£23 to £23 5s.	...
e	Mica (in original cases) small ... per lb.	6d. to 3/-	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,,	10/- to 20/- & up	...
p	Phosphor Bronze, plain castings ,,	1/3½	...
p	,, ,, drawn bars & rods ,,	1/5	...
p	,, ,, rolled strip & sheet ,,	1/3½	...
p	,, ,, wire... ... ... ,,	1/6	...
o	Platinum ... ... per oz.	£13 10s.	...
d	Silicium Bronze Wire ... ... per lb.	1/2	...
r	Steel, Magnet, in bars ... ... ,,	7½d.	...
g	Tin, Block (English) ... ... per ton	£180 10s. to £181 15s.	15/- to 20/- inc.
n	,, Wire, Nos. 1 to 16 ... ... per lb.	3/5	1d. dec.

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Reporting on December 21st, Messrs. James Forster & Co. stated that the lead market was again very quiet last week until December 20th, when, on a sudden demand for December lead, this position rose 5s. per ton, while forward fell 1s. 3d., thus establishing a backwardation on prices of 5s. per ton. This sudden scarcity of December lead is said to be due to the fact that a steamer from Mexico with a considerable quantity of lead on board has been delayed. As the producers have reduced their stocks in this country very considerably during the last few months, and there is little other lead arriving, only a small quantity of lead is available to fill up the gap before the next arrivals. Fortunately, with the approach of the holidays, consumption is at its minimum, otherwise a very acute position might arise.

The British Industries Fair.

The *Birmingham Post* reports that at a recent meeting of the Birmingham Tame & Rea District Drainage Board, an application was received from the British Industries Fair for an extension of the area of land leased from the Board at Castle Bromwich. As the land required by the Fair authorities formed part of the playing fields area in the occupation of the Birmingham Parks Department, negotiations had taken place as to the conditions under which the land could be transferred. The Parks Committee had agreed to surrender its leasehold interest in the land (about 22½ acres) south of the approach road from Chester Road and adjoining the Fair grounds subject to adequate compensation being paid by the Birmingham Chamber of Commerce for any loss of revenue the Committee might incur. It was decided to accede to the request made by the Chamber of Commerce for that area to be added to its existing holding.

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Lighting and Power Notes.

Australia.—VICTORIA.—The revenue returns of the State Electricity Commission for the quarter ended September 30th last record a total revenue of £478,678, as compared with £412,868 in the corresponding quarter of last year. Expenditure, including interest on loans, depreciation, and contribution to sinking fund totalled £471,355, as against £404,565, leaving a net surplus of £7,323 (£8,303). The sales of electrical energy increased from 91,582,957 to 104,814,331 kWh, and the maximum supply demanded from 77,730, to 86,800 kW. There was an increase of 20 in the number of towns receiving supplies from the Commission, bringing the total to 144. The ring main for supplying energy to the north-central and north-western districts of Victoria, including Ballarat and Bendigo has now been completed as far as Castlemaine, and arrangements are being made to take over the distribution in that centre, where the local private undertaking has been acquired.

SYDNEY.—The City Electricity Department is to lay underground cables to improve the electricity supply in the eastern and northern suburbs, at a cost of £352,000. A new substation is also to be constructed in Dalley Street, and feeders provided, at a cost of £178,000.

Bedford.—LOANS.—The Corporation Electricity Committee is to apply for sanction to loans of £20,000 for house services and £15,000 for apparatus for hire.

MAINS EXTENSIONS.—The Committee is to extend mains at an estimated cost of £641.

Burnley.—EMERGENCY SUPPLY PRECAUTIONS.—The Electricity Commissioners have agreed to the linking up of Burnley with the Nelson station as an additional safeguard in case of emergency.

Bury St. Edmunds.—CHANGE-OVER.—The Town Council has decided, in order to provide labour for the unemployed, to carry out work in connection with the change-over of a section of the area from d.c. to a.c., at a cost of £4,340, including a switchboard, a 100-kW rotary convertor, and 800 yd. of service cable.

Carlisle.—MAINS EXTENSIONS.—The city electrical engineer has reported to the Electricity Committee that, in connection with the unemployment grant schemes recently sanctioned in respect of extensions to mains, besides the mains laid, or in process of being laid, in certain streets, it is proposed to carry out further extensions as part of the scheme, as early as possible, amounting to £8,123.

Chester.—CHANGE-OVER SCHEME.—The Corporation Electricity Committee recommends the changing of the system of electricity supply from d.c. to a.c. during the next three years, at an estimated expenditure of £70,000.

Continental.—GERMANY.—The power station at Golpa-Zschornewitz, near Halle, central Germany, is now claimed to be the largest station in the world which uses lignite as fuel, which position has been reached by the recent starting of two turbo-generators, each of 100,000 kVA, over twice the size of the machines in use at the Berlin Klingenberg station. The station is the property of the Electro Works Company, of Berlin, which is in State ownership, and its capacity of 440,000 kW can be augmented to 730,000 kW by direct connection with other works owned by the company. The electricity from the Golpa works is transmitted by means of 100,000-V lines to Berlin, Magdeburg, and other towns, while other customers are the Reich railways, the Bavarian nitrogen works in Piesteritz, and some works of the Dye Trust.

FRANCE.—A decree published in the *Journal Officiel* approves the convention between the French Ministry of Public Works and the Sté. Union des Producteurs d'Electricité des Pyrenées for the exploitation of hydro-electric works in connection with three waterfalls: (1) of about 450 m. on the Neste de Caillaouas, (2) of about 460 m. on the Neste de Clarabide, and (3) of about 260 m. on the Neste de Lapès, of which the total net capacity is estimated to be 26,000 kW. Among other work, the Caillaouas lake is to be transformed into a reservoir. The main object is to regulate the output of the hydro-electric stations connected with the Cie. des Chemins de Fer du Midi and belonging to the Union des Producteurs d'Electricité des Pyrenées Occidentales.

Cottingham.—INAUGURATION OF SUPPLY.—The ceremony of switching on the electricity supply for the town was performed on December 17th by Councillor Benno Pearlman, Deputy Lord Mayor of Hull and chairman of the Hull Corporation Electricity Committee.

Douglas (Isle of Man).—EXTENSION APPLICATION REFUSED.—The Manx Tynwald Court has refused the application of the Douglas Corporation for permission to extend its area of electricity supply so as to include Onchan Village and Onchan Head. The application was opposed by the Manx Electric Railway Co., Ltd., which has supplied Onchan with electricity for the past thirty years.

Dronfield.—DIRECT SUPPLY.—The Urban District Council has accepted the offer of the Sheffield Corporation to supply electricity direct to Dronfield consumers at 20 per cent. above the Sheffield prices. The Council has also decided to support the Corporation's application to take over the powers vested in the Urban District Council under the Dronfield Electricity Order, 1928.

Ilfracombe.—SPECIAL ORDER.—The Electricity Commissioners have submitted for confirmation a Special Order made by them authorising the Ilfracombe Electric Light & Power Co., Ltd., to supply electricity in part of the rural district of Barnstaple.

King's Lynn.—NEW PLANT.—The Corporation electrical engineer recently presented a report upon the position of the electricity department in regard to the demand for supplies in the near future. The report was approved, and it was resolved that application be made for sanction to the borrowing of £40,000 for the provision of a 4,000-kW turbo-alternator, and for work in connection therewith.

Llandilo.—ELECTRICITY SUPPLY.—The Rural District Council has arrived at an agreement with the Llanelly and District Electric Lighting & Traction Co., Ltd., for the supply of electricity in the parish of Llandebie at the following terms:—Lighting, 7d. per kWh; heating, 2d. per kWh; and power, a sliding rate varying from 4d. to 1d. per kWh according to the quantity consumed.

London.—STOKE NEWINGTON.—The Borough Council has received sanction to the borrowing of £7,045 for mains, and £8,235 for plant.

The Borough Council Electricity Committee recommends the laying of distributor cables, at an estimated cost of £1,517.

WANDSWORTH.—The Borough Council has approved proposals by the County of London Electric Supply Co., Ltd., for the laying of conduits in 21 thoroughfares within the borough.

WOOLWICH.—The Borough Council Electricity Committee has made the following decisions:—(*a*) That the scale of maximum demand charges be altered to provide steps of 50 watts upwards from a minimum of 200 watts, subject to restriction, and that the lowest maximum demand that can be accepted under this scale is half a watt per sq. ft. of ground floor area. (*b*) That the discount of 5 per cent. hitherto allowed on both tariff and flat rates of charges be discontinued. (*c*) That the charge for the supply of electrical energy for heating and cooking for commercial purposes, be at the rate of £4 per kW, based on 25 per cent. of the maximum demand installed, plus ½d. per kWh, net. (*d*) That a charge for the supply of electrical energy alternative to the existing rate of 2.9d. and 1.9d. per kWh to small power users, be fixed at £8 per h.p. installed, plus ½d. per kWh net.

NORTH MET. PROGRESS.—The North Metropolitan Electric Power Supply Co. announces that this year, up to December 3rd, it had, for the first time in its record, connected more than 10,000 new consumers. The total number of consumers at the date mentioned was 58,000.

ST. MARYLEBONE.—The Borough Council Electricity Supply Committee recommends the expenditure of a sum estimated at £34,915, for the provision of cables and switchgear in connection with future bulk supplies to the Hampstead Borough Council.

HAMMERSMITH.—The Borough Council Electricity Committee makes the following recommendations:—(*a*) That, as from the quarter ended September 30th last, the minimum charge of £1 per consumer per annum for the supply of electricity be abolished; (*b*) that an additional £6,000 be provided to finance the assisted wiring scheme; and (*c*) that an additional sum of £1,000 be provided for the supply of electrical apparatus for hire and hire-purchase.

Marple.—UNDERTAKING PURCHASE OFFER.—An offer has been received from the Trent Valley and High Peak Electricity Co., Ltd., to take over the Special Orders of the Marple and New Mills Urban District Councils. Should the Councils decide to operate their Orders, electricity will have to be purchased from the company, which has already received powers in connection with bulk supply. The company, which claims to be able to supply electricity at a cheaper rate than the Councils, has also made application for an Order authorising it to supply electricity in the Hayfield and Glossop rural districts.

Paignton.—EXTENSION OF SUPPLY AREA.—At a recent meeting of the Urban District Council, the clerk reported that the Brixham Gas Co. was promoting a Bill empowering the company, *inter alia*, to extend the area within which it is authorised to supply electricity, so as to include part of the urban district of Paignton at Broadsands.

Ponterwyd.—INAUGURATION OF SUPPLY.—An electricity supply installation, carried out by Mr. J. Herbert Edwards, of Gloucester, was inaugurated recently by Miss Olwen Rhys, daughter of Sir John Rhys, a resident of the district. The installation has been provided free of charge, and all profit made by installing electric light for residents and for energy used will go towards village improvements.

Price Reductions.—Reductions in the charge for electricity have been made or recommended in the following districts:—

LLANDILO.—Lighting: From 8d. to 6d. per kWh. Power: From 4d. to 3d. per kWh.

PONTEFRACT.—*Yorkshire (West Riding) Electric Tramways Co., Ltd.*—Lighting: From 7d. to 6½d. per kWh.

Ribchester.—ELECTRICITY SUPPLY.—Through the agency of Messrs. Bannister Bros., of Bee Mill, Ribchester, electricity is to be supplied to the village. The cable will be laid to the firm's mill by Preston Rural District Council, and the supply will be distributed by Messrs. Bannister.

Swansea.—MAINS EXTENSION.—The Corporation Electricity Committee is to extend mains at an estimated cost of £1,122. The Committee has also decided to change over from d.c. to

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a.c. in the Wassail Square district and to install the necessary a.c. mains, at an estimated cost of £780.

UNEMPLOYMENT SCHEME.—The Corporation Electricity Committee has agreed to a recommendation of the borough electrical engineer that the following works, which in the ordinary course would not be proceeded with for a period of at least three years, be put in hand forthwith for the purpose of relieving unemployment:—Replacing the existing d.c. distributors and feeders, and the whole of the a.c. triple-concentric cables in the following areas:—Swansea west, £28,050; centre of town, £25,969; Swansea north, £6,435; and Morriston, £7,507.

Torquay.—NEW PLANT.—The Town Council is applying for sanction to a loan of £98,780 for additional generating plant at the Newton Abbot power station.

Tynemouth.—METER RENT REDUCTION.—The Corporation Electricity Committee has decided that the meter rents in respect of lighting be reduced as follows, as from the quarter ending March 31st next:—For 30 lamps, from 2s. to 1s. 6d.; for 50 lamps, from 2s. 6d. to 2s.; for 100 lamps, from 3s. to 2s. 6d.; and over 100, from 4s. 6d. to 4s.

United States.—FLOATING GENERATING STATION.—Instructions have been given to the U.S. aircraft carrier *Lexington* to act as a generating station to the town of Tacoma, on Puget Sound, in the State of Washington. According to the *Daily Mail* this use of a Navy ship is due to a long drought in the district, which has seriously diminished the water supply of Tacoma's electricity system. In dock the *Lexington* is generating electricity during 12 of the busiest hours of the day and the Navy is charging the city £9,000 as a first charge and a halfpenny per kWh. It is estimated that the ship will serve the town for at least a month.

LARGE BOILERS.—Some 90 men recently sat down to luncheon in the newest of the three boilers installed in the East River generating station of the New York Edison Company, Fourteenth Street and the East River. They are the largest boilers in the world, and the luncheon was in recognition of the men whose skill made possible the completion on schedule time of the $12,500,000 addition to the city's electricity system of 215,000 horse-power. Seated inside one of the boilers, 10 ft. above the bottom and 85 ft. below the steam drums, the platform on which they sat was 43 ft. 6 in. long, by 23 ft. 6 in. wide. Floodlight illuminated the rows of more than 3,700 tubes, whose total length is 23 miles, the 11 steam drums, the pulverised coal burners, and other equipment.

The boiler, No. 9, is the final one of three installed since June 1st to provide steam for the single-unit, single-shaft, turbo-generator of 160,000 kilowatts installed by the American General Electric Co. The three boilers were built by the Combustion Engineering Corporation. The superheat temperature is 725 deg. F., and the pressure 425 lb. per sq. in., and each boiler would require almost 1,000 tons of coal a day if operated continuously at full capacity. The condenser was manufactured by the Ingersoll-Rand Company; it has 90,000 sq. ft. of cooling surface and will condense 700 tons of steam an hour. The pumps can draw 160,000 gals. of water from the East River every minute.

Walsall.—POWER-STATION FUMES.—Following complaints by residents in Walsall concerning an alleged nuisance caused by the emission of smoke and grit from the power-station chimneys, the West Midlands Joint Electricity Authority has notified the Town Council that it proposes to spend £2,000 on plant which, it is anticipated, will abate this trouble.

Tramway and Railway Notes.

Brazil.—RAILWAY ELECTRIFICATION.—Modified plans have been prepared for an electrified single mountain line for the Sao Paulo Railway. To ascend the 800-metre elevation on a 2 per cent. grade, 40 km of track would have to be constructed, compared with 10 km. as at present, and the distance from Santos to Sao Paulo would thus be increased from 79 to 109 km. It is stated that a 3 per cent. grade would be possible with electric traction, which would reduce the mountain section to 26.6 km, and increase the total distance to 95.6 km. As at present determined, the new line would follow a route through two adjoining valleys, that of the Mogy river, at present used for the inclined planes, and the Quilombo river. The total expenditure, including electrification, is estimated at between £4,000,000 and £5,000,000.—*Reuter's Trade Service* (Sao Paulo).

Continental.—ITALY.—An underground railway estimated to cost approximately £8,000,000 is to be constructed in Rome. Three separate lines will connect the city with the principal residential districts, the total length of the railway according to the initial scheme amounting to about fifteen miles.

London.—TRAMWAY EXTENSIONS.—The London County Council Highways Committee recommends the construction of tramways in the section of the South Circular Road from Eltham Road to Well Hall Road, at an estimated cost of £18,000.

EXPERIMENTAL TRAMCAR.—The Highways Committee of the London County Council reports that, in view of the present-day trend towards improvement in design and appearance of public service vehicles, and in order that the tramcars of London shall not be lacking in this respect, it considers that steps should be taken to explore the possibility of improving upon the latest type of car approved for use on the Council's system. The Committee recommends, therefore, that a sum of £5,000 be expended on the construction of an experimental tramcar.

Swansea.—TRAMWAY RECONSTRUCTION.—The Corporation Tramways Committee has authorised the borough engineer to proceed with the reconstruction of the tramway track in Mansel Street and Cradock Street, and with the work in connection with the proposed scheme for the widening of St. Helen's Road for the doubling of the track.

The Southern Railway.—COLLISION.—A collision occurred in the fog on December 11th between two electric trains at Purley Station, shortly after 5 p.m. One coach was derailed but, although the line was not completely cleared till late in the evening, it was possible to maintain a 20-minute service throughout the evening. Two passengers were injured.

THE WIMBLEDON-SUTTON LINE.—January 5th is the date fixed for the opening of the Southern Railway Company's new line from Wimbledon to Sutton. An electric service of twenty minutes in rush hours, and 30 minutes at other times, will operate between Holborn Viaduct and West Croydon, connecting at Sutton with services to and from Victoria, and at Wimbledon with services to and from Waterloo.

Telegraph and Telephone Notes.

Radio Beacons.—PLYMOUTH.—The Great Western Railway Company is considering the construction of a beam radio beacon to assist the navigation of shipping in Plymouth Sound during fog. The only stations of the kind proposed in the west at present are at Start Point and The Lizard. The company contemplates erecting a new directional beacon at Penlee Point, at the western end of Plymouth Sound. The company, which owns the docks at Plymouth, is prepared to bear the cost of building and equipping the station and necessary apparatus, but *The Times* understands that it is not prepared to undertake an annual expenditure of £600 to £1,000 on maintenance.

Rumania.—TELEPHONE SERVICE.—It is reported from Berlin that a representative of the A.E.G. has made an offer to the Rumanian Ministry of Communications to modernise the country's telephone system. In particular, the proposal aims at the establishment of automatic exchanges in large cities, the laying of underground cables, and the supply of telephone apparatus and accessories. As the A.E.G. itself does not produce telephone apparatus, it is assumed that the negotiations are being made on behalf of some firm connected with the Berlin company.

Spain.—RADIO TELEPHONY.—A new radio-telephone service linking up Spain and Chile, South America, was inaugurated on December 20th.—*Reuter's* (Madrid).

The Telephone Service.—WESTERN SCOTLAND.—Telephone communication by submarine cable has been established between Oban and the island of Kerrara, in Oban Bay, the first of the Western Isles to have a direct telephone service to the mainland.

RURAL AUTOMATIC EXCHANGE.—A new exchange of the rural automatic type has been provided for the Great Alne district. Local subscribers will dial each other direct, but outside area calls will pass through the Alcester exchange operators.

Transatlantic Cables.—OCEAN BED CHANGES.—According to reports from the cable steamers now attempting to repair the submarine telegraph cable breaks caused by the earthquake off the North American East Atlantic coast, the ocean bed has been radically changed over the affected area and will need to be recharted. Soundings taken over an area of 200 miles' length when approaching Cape Race showed variations as great as 40 to 50 fathoms from the soundings recorded on existing charts; only a few of the chart soundings were found to be correct.

U.S.A.—CABLE AND WIRELESS UNIFICATION.—The regulation of the communication system, including radio, cables, and land wires, preferably by a special Minister of Communications who would be a member of the Cabinet, was recommended by General Harbord, president of the Radio Corporation of America, before the Senate Committee on Inter-State Commerce. He strongly urged legislative action to permit the creation of a unified communication service under the control of one authority.—*Reuter's* (Washington).

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Radio Notes.

Australia.—POLICY CHANGE?—The recent Federal election having resulted in the formation of a Labour Government in succession to the Nationalist Ministry may mean another change in broadcasting policy. It is pointed out that the Prime Minister favours "Government ownership and control," but just what he meant by that statement is not clear.

Brookman's Park.—ALTERNATIVE TEST.—On Sunday, December 22nd, and on every Sunday until further notice, an alternative programme test transmission was radiated from 2 to 3 p.m. by the two transmitters at Brookman's Park and Daventry (5XX). This test was added to the existing series in order to assist those who cannot take advantage either of the morning or evening tests on week-days. One transmitter at Brookman's Park radiated on the regional programme wave-length of 356.3 metres, while the other radiated on the national programme wave-length of 261.3 metres. Daventry (5XX) radiated the same programme as the 261-metre Brookman's Park transmitter.

Licences.—EVASION.—At Bolton on December 12th a Post Office official said that considerable evasion was still going on in wireless licences. It was difficult to detect cases, however. An offender who was charged with installing a three-valve set and working the apparatus without a licence, and was fined £1 and £2 2s. costs, said he had an indoor aerial and was under the impression that it was not necessary to take out a licence until the set was working properly.

South Africa.—LICENCES.—There are approximately 16,500 licensed listeners in the Union, who, however, can obtain reliable reception from one of three stations only. Johannesburg claims 6,900, Cape Town 5,500, and Durban 4,100. The African Broadcasting Co. continues to loose considerable money annually, says *Wold-Radio*, and the Press is advocating State control of the service with the Canadian system as a possible example.

U.S.A.—STATION SITES.—The State of New Jersey has taken legal steps to defend its "right of denial or acceptance" concerning broadcasting concerns which wish to set up transmitters within the confines of the State. The specific question to be settled is whether the Columbia system shall be permitted to install, without New Jersey's sanction, its new 50,000-watt transmitter at Columbia Bridge, near Morristown, in accordance with a permit issued recently by the Federal Radio Commission, and the result will set a legal precedent for every State in the Union. It is contended by the New Jersey Radio Commission that the new WABC high-power transmitter, if placed near Morristown, will effectively "blanket that city, together with Montclair, The Oranges, and Newark," and New Jersey thinks it should have a say in the question whether any such broadcaster may set up a station on State soil without the people having a voice in the matter, as it is claimed that such transmitters ruin reception for listeners who reside nearby.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—Posts and Telegraph Department. February 18th. Jacks and number plates. (B.X. 5940.)*
February 25th. Jumper rings and terminal strips. (B.X. 5941.)*
February 26th. Victorian Railways. Deaerators and accessories. (A.X. 8935.)*

Belgium.—January 8th. Belgian Posts and Telegraphs. Salle Madeleine, Brussels. 250 tons of bronze wire, in five lots, and five tons of annealed soft copper wire. Particulars (Cahier des Charges Special No. 3455) for 2½ francs.

Bradford.—December 31st. Corporation electric passenger- and goods lifts at block at shop and office premises, Leeds Road, Bradford Street, and Hall Buildings. Form of tender from city architect, Town Hall.

Dumbartonshire.—The Education Authority is inviting tenders for the installation of electric light in Cardross Public School.

Dundee.—January 15th. Electricity Department. Supply of two 300-kVA outdoor-type transformers and one 200-kVA outdoor-type transformer. (December 20th.)

Grimsby.—January 23rd. Electricity Department. One 10,000-kW, 3-phase turbo-alternator with condensing plant. (See this issue.)

India.—South Indian Railway Co., Ltd. January 24th. Madras improvements, electrification, cables, and accessories. (See this issue.)

London.—CENTRAL ELECTRICITY BOARD.—January 6th. Supply, delivery, and erection of 132-kV overhead transmission lines (special crossings and high spans), for the North-West England and North Wales Electricity Scheme, 1928. (November 29th.)
January 20th. Supply, delivery, and erection of 3,300-V, 6,600-V and 11,000-V switchgear for connecting the Board's supply to undertakers' busbars, North-West England and North Wales Scheme. (December 13th.)
ISLINGTON.—Borough Council. January 17th. Electrical and engineers' stores for one year commencing April 1st next. (December 13th.)
METROPOLITAN ASYLUMS BOARD.—January 2nd. Replating a 500-ampere-hour electrical storage battery at St. Luke's Hospital, Lowestoft. (December 13th.)

Lourenço Marques.—January 3rd. Tender Department of the Treasury. One oil-engine-driven d.c. generator and battery. (B.X. 5961.)*

Maidstone.—January 16th. Committee of Visitors. Electrical installation for lighting, heating, &c., at the Mental Hospital, Barming Heath. (December 20th.)

New Zealand.—WELLINGTON.—Post and Telegraph Department. January 21st. Spare parts for automatic telephones. (B.X. 5917.)* Reed-type tension gauges. (B.X. 5918.)*
January 27th. Breastplate transmitters. (B.X. 5956.)*
February 3rd. Protector blocks made of carbon and porcelain. (B.X. 5948.)*
February 13th. Opal lamp caps. (B.X. 5955.)*
Public Works Department. January 21st. Four electric motor-driven ventilating fans. (A.X. 8857.)*

South Africa.—PORT ELIZABETH.—January 9th. City Council. Electric cables, transformers, and sundry electrical materials. (B.X. 5980.)*

Stoke-on-Trent.—December 31st. North-West Midlands Joint Electricity Authority. Supply and erection of e.h.p. and l.p. overhead transmission lines. (December 13th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Bedford.—Education Committee. Recommended:—
Tubular electric heating at Ampthill Road schools (£762).
—Young, Osmond & Young, Ltd.

Bexhill.—Health Committee. Recommended:—
Electric lighting and power installation at isolation hospital (£149).—H. W. Elsworth.

Dumfries.—Dumfries and Galloway Joint Sanatorium Board. Accepted:—
Accumulator for the sanatorium (£534).—Hart Accumulator Co., Ltd.
Town Council:—
Main switchgear, etc., for the new turbo-alternator plant (£534).—Metropolitan-Vickers Electrical Co., Ltd.

Government Contracts.—The following contracts were placed by Government Departments during November:—

ADMIRALTY (CONTRACT AND PURCHASE DEPARTMENT).
Motor alternators.—Haslam & Newton, Ltd.
Electric cables.—Anchor Cable Co., Ltd.; British Insulated Cables, Ltd.; Craigpark Electric Cable Co., Ltd.; Enfield Cable Works, Ltd.; Pirelli-General Cable Works, Ltd.; W. T. Glover & Co., Ltd.; Greengate and Irwell Rubber Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Hooper's Telegraph and India Rubber Co., Ltd.; India Rubber, Gutta Percha & Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Liverpool Electric Cable Co., Ltd.; Macintosh Cable Co., Ltd.; Mersey Cable Works, Ltd.; St. Helens Cable & Rubber Co., Ltd.; Siemens Bros. & Co., Ltd.

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Petrol-electric mobile crane.—Ransomes & Rapier, Ltd.
Electric overhead cranes.—Vaughan Crane Co., Ltd.; Cowans, Sheldon & Co., Ltd.
Floodlights.—Engineering & Lighting Equipment Co., Ltd.
Generating sets.—Petters, Ltd.; Ferry Engine Co.; A. G. Mumford, Ltd.
Motor-generator set.—British Thomson-Houston Co., Ltd.
Electrical installation.—British Thomson-Houston Co., Ltd.
Control panel, switchboard, &c.—Whipp & Bourne, Ltd.
Electric overhead travellers.—Cowans, Sheldon & Co., Ltd.
Conduit tubing.—General Electric Co., Ltd.

WAR OFFICE.

Generators.—British Thomson-Houston Co., Ltd.
Electric lamps.—British Thomson-Houston Co., Ltd.
Electric cranes.—Herbert Morris, Ltd.
Battery for electric locomotive.—D.P. Battery Co., Ltd.

AIR MINISTRY.

Electrical controls.—Williamson Manufacturing Co., Ltd.
Fans.—General Electric Co., Ltd.; F. & C. Osler, Ltd.
Aircraft sparking plugs.—K.L.G. Sparking Plug Co., Ltd.
Dimmer switches.—Pyne Manufacturing Co., Ltd.
Sparking plug testers.—Adamant Engineering Co., Ltd.
W/t valves.—A. C. Cossor, Ltd.; Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.
Wavemeter spares.—Marconi's Wireless Telegraph Co., Ltd.

POST OFFICE.

Telephonic apparatus.—Automatic Telephone Manufacturing Co., Ltd.; General Electric Co., Ltd.; Phœnix Telephone & Electric Works, Ltd.; Siemens, Bros. and Co., Ltd.; Standard Telephones & Cables, Ltd.; Sterling Telephone & Electric Co., Ltd
Testing and protective apparatus.—General Electric Co., Ltd.; Phœnix Telephone & Electric Works, Ltd.
Wireless apparatus.—David Brown & Sons (Huddersfield), Ltd.; General Electric Co., Ltd.
Cable.—British Insulated Cables, Ltd.; Connollys (Blackley), Ltd.; W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros. and Co., Ltd.; Standard Telephones & Cables, Ltd.
Loading coils.—Standard Telephones & Cables, Ltd.
Telephone cords.—British Insulated Cables, Ltd.; Phœnix Telephone & Electric Works, Ltd.; Reliance Electrical Wire Co.; Standard Telephones & Cables, Ltd.
Manufacture, supply, drawing-in, and jointing of cable.—Salisbury-Basingstoke.—Pirelli-General Cable Works, Ltd.
Telephone exchange equipment.—Hop (London, S.E.), Smethwick (Birmingham), Basford (Nottingham), Sydenham and Woking.—Automatic Telephone Manufacturing Co., Ltd. Didsbury (Manchester).—General Electric Co., Ltd. Silverhorn (Chingford).—Standard Telephones & Cables, Ltd. Sub-contractors: Crompton Parkinson, Ltd., for ringing machines; Electric Construction Co., Ltd., for charging machines; Chloride Electrical Storage Co., Ltd., for batteries. Southend-on-Sea (Multi Area).—Standard Telephones and Cables, Ltd. Popesgrove (Twickenham), Rock Ferry.—Siemens Bros. & Co., Ltd.
Telephonic repeater equipment: Canterbury.—General Electric Co., Ltd. Dundee.—Standard Telephones and Cables, Ltd.
Power plant for repeater station.—Haslam & Newton, Ltd.

CROWN AGENTS FOR THE COLONIES.

Battery materials.—Chloride Electrical Storage, Ltd.
Cable.—Callender's Cable & Construction Co., Ltd.
Electric meters.—Ferranti, Ltd.
Insulators and ironwork.—Bullers, Ltd.
Ironwork.—Siemens Bros. & Co., Ltd.
Motor-alternator exciter sets.—Electric Construction Co., Ltd.
Static transformers.— Johnson & Phillips, Ltd.
Telephones.—Ericsson Telephones, Ltd.; General Electric Co., Ltd.
Wireless apparatus.—Marconi's Wireless Telegraph Co., Ltd.

Ilford.—Tramways Committee. Recommended:—
Three car bodies (£3,810).—Brush Electrical Engineering Co., Ltd.

London. — SHOREDITCH. — Lighting Committee. Recommended:—
Boiler (100,000 lb. per hour evaporative capacity) and auxiliaries (£21,174).—Stirling Boiler Co., Ltd.
HAMMERSMITH.—Electricity Committee. Recommended:—
Three 100-kVA 3-phase transformers (£1,177).—British Electric Transformer Co., Ltd.
HACKNEY.—Electricity Committee. Accepted:—
Boilers and coal handling plant for the Millfields Road generating station (approx. £250,000).—Simon-Carves, Ltd.
STOKE NEWINGTON.—Electricity Committee. Recommended:
Lamp columns.—Bromford Tube Co., Ltd.
Lanterns.—Holophane, Ltd.
Time switches.—Acme Lighting & Engineering Co.

Mersey Railway.—Accepted:—
3,800 Osram lamps for station lighting.—General Electric Co., Ltd.

Forthcoming Events.

Schoolboys' Exhibition.—Horticultural Hall, S.W., December 31st—January 8th.
Physical Society.—Thursday, January 2nd, Imperial College of Science, S. Kensington, S.W., 5 p.m. Ordinary meeting.
Institution of Electrical Engineers (Meter & Instrument Section).—Friday, January 3rd. Institution, Savoy Place, W.C., 7 p.m. "Instrument Transformers." Mr. J. G. Wellings and Mr. C. G. Mayo.
Institution of Mechanical Engineers.—Friday, January 3rd, Institution, Storey's Gate, S.W., 6 p.m. Thomas Lowe Gray Lecture. "Progress in Marine Engineering." Eng.-Vice-Admiral R. W. Skelton.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of makers of the following:—

We are asked for the present address of the SANITAS ELECTRICAL Co., late of 61, New Cavendish Street, London.

Notes.

Snow Disturbances on H.V. Transmission Lines.

At the recent International Conference on High-voltage Transmission Distribution Systems in Paris, Mr. S. Fukunaka and Mr. T. Uyeno, two Japanese electrical engineers, presented a report on disturbances caused by snow on the 154-kV power transmission lines of the Nippon Electric Power Co. The authors explained that snow which weighed only about 1½ lb. per cu. ft. rarely accumulated on the accumulators to an extent to affect the sag of lines, it being usually blown off by the wind before it could adhere to the conductors. On the other hand, dense snow weighing over 1½ lb. per cu. ft. stuck to the periphery of the lines, this often being experienced to the extent of a diameter of 10 in. If the layer of snow formed uniformly along the whole length of the line span the normal sag, owing to the increased weight, was increased about five times. In practice, however, the snow did not accumulate evenly, but settled on the most inclined portions and slid down and fell off rapidly. On one line that was carefully inspected the sag was increased to twice the normal by snow. When snow collected evenly on the whole length of a line consisting of three conductors, the increase in the sag was the same for each conductor, so that no disturbance was caused, but when the temperature rose, the accumulated snow commenced to fall off, giving rise to both vertical and horizontal movements of the conductors. Although the horizontal movements were not so great as the vertical ones, the resulting motion of the conductors which underwent a rapid change in weight caused a wave of which a short-circuit between the different phases was the natural result.

The authors reported that they had found the best method of dealing with such conditions to be that of melting the snow by the passage of an intense current before the accumulation became such as to cause disturbances. Following a series of tests, it had been found that a 400-A loading for from 20 to 30 minutes was sufficient to bring about the melting of the inner lay of snow, which quickly caused the outer layers to fall away. The current was passed through the conductors circuit by circuit, men being employed to pass signals to the controlling station that the line had been cleared of snow, so that the current could be turned over to the next circuit. The work was usually carried out between 4 and 8 a.m., and since the plan was adopted there had been a marked decline in the number of line disturbances due to snow.

Open-door Losses of Electric Furnaces.

The open-door losses for a given furnace temperature will depend upon the area of door opening, time door remains open, the number of openings per hour and design of furnace front and door. There are so many variables that it is not possible to give an average figure for this loss. If a door is opened once or twice an hour for very short periods, this loss can be neglected, but in the case of a box type vitreous enamelling furnace, when the door is opened 30 to 40 times an hour, this loss may exceed the stand-by loss.

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An actual test of a box type furnace operating at 1,600 deg. F., having a door 4 ft. wide, opened a distance of 18 in. high for a period of ten seconds plus an additional eight seconds for opening and closing, gave a loss of 1 kWh for each time door was opened.—*Electrical World.*

An American Diesel-Electric Tanker.

Construction is about to commence in the United States of a Diesel-electric tanker to operate between ports along the Atlantic coast. Her capacity will be approximately 20,000 barrels of petrol and approximately 55,000 gallons of lubricating oil, the latter to be carried in individual tanks in the forward hold space. The vessel will be very similar to one recently completed, and she will have a length of 255 ft., a beam of 44 ft., a draught of approximately 15 ft. 6 in., and a dead-weight of about 2,400 tons. The power plant will consist of two 6-cylinder, non-reversible, solid-injection oil engines, each rated at 625 shaft-horse-power at 225 r.p.m. They will be directly-connected to two direct-current generators, each rated at 410 kW at 225 r.p.m., 250 volts, shunt-wound. In addition, there will be three auxiliary generators, each rated at 45 kW at 240 volts, compound wound; two of them will be mounted on shaft extensions of the main generators, and the third will be directly-connected to a 3-cylinder solid-injection engine. These three generators will furnish power for excitation and also for lighting and the operation of auxiliaries. The propulsion motor will be a double-unit machine rated at 1,000 shaft-horse-power at 130 r.p.m., 500 volts. It will consist of two 500-horse-power, 130 r.p.m., 250-volt motors mounted on a common shaft with two bearings and base. Propulsion control will be on the variable voltage system, arranged for operation from both the engine-room and the pilot-house. The electrical auxiliaries will include two main cargo pumps, rated 75 horse-power each; two lubricating-oil cargo pumps, rated 15 horse-power each; a number of other pumps, and deck and other auxiliaries, the whole having an aggregate rating of 210 horse-power. Cooking and heating will be carried out electrically also.

A Large Combustion Control Installation.

It is a matter of interest to know that the Hull Corporation Electricity Department has decided to adopt a complete system of "Hagan" automatic boiler control for the five Clarke Chapman boilers in the new boiler house. Each boiler has a normal evaporation of 80,000 lb. of steam per hour at a working presesur of 400 lb. per sq. inch. The boilers are equipped with type "L" chain-grate stokers of the Underfeed Stoker Co., Ltd. The "Hagan" system will be designed to control both fuel and air supplies in accordance with steam demand. The air supply will be controlled from a master regulator sensitive to minute variations of steam pressure by means of suitable dampers at the forced and induced draught fans, and the fuel supply will be similarly controlled from the master regulator by regulating speed of the stoker motors. For this purpose d.c. variable-speed motors will be installed, one motor per stoker, and the automatic switchgear will be designed in such a way that small hand adjustments can at any time be made if desirable when variations in fuel quality take place. A separate regulator for each boiler will check automatically the draught variation in that particular boiler by operating a damper in the forced-air duct. This system will embody control panels by means of which the load on each particular boiler will be able to be increased or decreased at will or from which the boiler can be regulated by hand if at any time desired. These panels increase the flexibility of the system, and are supplied for practically all installations of "Hagan" automatic boiler control on large water tube boilers. The whole of this automatic system is being installed by James Gordon & Co., Ltd.

Reliability of Overhead Lines.

On a service basis good transmission practice is subject to 15 or 20 interruptions per year per one hundred miles of 100-kV line, according to a survey made by the Great Lakes Engineering Section of the N.E.L.A. From seven to ten of these interruptions were attributed to lightning, and for two successive years lines without ground wires suffered almost twice as many lightning interruptions as did those provided with ground wires. These data undoubtedly show the ability of ground wires to reduce lightning troubles. But lightning troubles are less than 50 per cent. of the service interruptions, and there is a big opportunity for improvement in performance, by eliminating chances for mechanical failures, improving relay operation, providing for better switching and insuring proper clearances to ground and between phases. These things can be done to the advantage of the service.

The superior efficacy of the double-circuit line, as compared with the single-circuit line, is shown by the data in that only 15 per cent. of the troubles caused a simultaneous trip-out of both circuits. It is also interesting to note that only about 6 per cent. of lightning flashovers resulted in burnt-down lines and that data on porcelain injured from arcs or punctures were very meagre.

There is no reason to doubt the economic feasibility of reducing interruptions to the order of ten, instead of twenty, per year per hundred miles of line.—*Electrical World.*

A New Sun-Lamp.

A new type of sun-lamp for use in the home to aid the maintenance of health has been brought out in the United States. The bulb is made of special glass that eliminates the shorter ultra-violet rays, which, it is said, should be used only under the supervision of a physician; it permits only the passage of beneficial rays, corresponding to direct sunlight through a clear atmosphere at midsummer, so that goggles and other protective devices are, therefore, no more necessary when the lamp is used than when a person exposes himself to the natural sun. Short exposures, graduated daily, reaching a maximum of approximately 30 minutes, are recommended, which amount of exposure is believed to be sufficient to produce a gradual tan, without burning the skin. Within an ornamental reflecting shade at the top of the standard is the special bulb, much like the usual incandescent lamp in appearance. The base of the standard is an ornamental housing enclosing a transformer for reducing the domestic voltage from 110 volts to the operating potential of the lamp, which has a conveniently located operating switch on the upright shaft, can be plugged into any convenient outlet, and can be rolled easily from room to room. The lamp reflector is adjustable, so that it can be inclined at an angle when desired. A tungsten filament and a pair of tungsten electrodes are contained within the bulb. When switched on the filament is lighted to bright incandescence, and the heat so liberated quickly vaporises a small quantity of mercury within the bulb, so that within a second or so a mercury arc is set up between the two tungsten terminals that are attached to the same supports as is the filament. When the arc has fully developed, the circuit is completed between the tungsten electrodes, the path of least resistance, which action automatically cuts the filament out of circuit.

Appointments Vacant.

Engineer for the development of the showroom and the use of electricity for Chester City Council. Junior assistant mains engineer for Salford Corporation. Mains assistant (£251) for the City of Norwich Electricity Department. Assistant mains engineer (£212) for the City of Salford Electricity Department. E.H.P. cable-jointer (545 Rs. monthly) for the Calcutta Electric Supply Corporation. Power stations engineer (£900) for the City of Manchester Electricity Department. Borough electrical engineer for West Hartlepool Corporation. (See our advertisement pages to-day.)

Electrical Development in Norway.

Although since the 1914-18 war progress has been achieved in the production and distribution of electrical energy in practically all countries, it is in Norway, according to *Le Génie Civil*, that such progress, per head of population, attains the greatest importance. The capacity of the hydro-electric stations belonging to the State, to the towns, to other local administrations, and to private enterprise, reaches 500,000 kW. The distributing systems directed by municipal authorities amount to 95 per cent. of the total; the demand by the towns amounts to 243,000 kW, and by the other municipal authorities to 141,500 kW. The towns and municipal authorities supply electricity to 70 per cent. of the population, and the consumption per head is 282 watts in the towns and 131 watts in the rural districts. Owing to the wide employment of heating and cooking apparatus the generating stations are able to work five to six thousand hours per year at maximum load, a figure which is not attained in any other country, notwithstanding the heavy distributing cost due to there being only eight inhabitants per square kilometre. On the other hand, artificial light is employed for 1,200 hours per year, and domestic heating during six months out of the twelve. In Norway electricity is distributed uniformly at 50 periods, but at various voltages. The latter are now being standardised at 5, 10, 20, and 45 thousand volts for transmission and at 220 for distribution.

Birmingham Electric Club.

The annual general meeting of the Birmingham Electric Club on December 20th. Thirty-nine new members were elected during the 1929 session, bringing the total membership up to 263. The statement of accounts for the session shows an income of £311, resulting in a balance of £200.

Elements for Electric Heating Appliances.

A number of problems encountered in the application of heat by electrical resistors working in restricted space have been met by the use of the metal-sheathed type of element. Sheath elements consist, in general, of five parts—the sheath, the coiled resistor, the "cold" terminals, the connection terminals, and the insulation. The elements are made by winding a helix of nickel-chromium wire and attaching "cold" terminals of heavy nickel wire. The resistor, with its terminals, is assembled in a straight tube (of copper, steel, nickel, or other suitable material) and the tube is filled with the insulating material, *e.g.*, magnesium oxide; the whole element is then swaged until the magnesium oxide is highly compressed. The unit can be formed into intricate shapes, can be varied in length and wattage, and is adaptable to a very wide range of applications. The sheathing must be selected with due consideration of the conditions in which the unit will be required to work, and may be composed of a variety of materials, *e.g.*, a nickel-plated copper sheath is in use for heating oils used in frying, sheaths of nickel-copper-zinc alloy are employed for units working, for various purposes, up to 1,000 deg. F. (540 deg. C.), while monel metal and other special materials are used for certain specialised applications of the sheath-metal resistor.—*The Nickel Bulletin.*

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Transatlantic Cable-telephony.

There is shortly to be laid across the Atlantic Ocean a submarine telephone cable to supplement the present long-wave Europe-America radio-telephony system. A telephone cable operating over such a distance involves special technical problems centred around the fact that the attenuation of the telephone currents increases enormously with frequency, and requires special amplification apparatus for correction. In the transatlantic radio system the length of the land line between London and Cupar (radio receiving station) is almost 450 miles and the line contains seven repeaters. It is obviously impracticable to dispose repeaters at intervals along the length of an Atlantic cable, so that the problem resolves itself into placing super-amplifiers at the ends of the cable. Recent patent literature indicates that the problem has been under consideration for some time and information available on the transmitting and receiving apparatus is novel and interesting. The design of the receiving amplifier is totally different from that of a normal amplifier, where constancy of amplification with frequency is generally the desideratum. In submarine cable telephony the amplification at the highest frequency of the commercial telephony range must be several thousand-fold that at the lowest frequency in order to cope with the enormous differential frequency characteristic of the proposed cable. In the special receiver the "correction" is obtained by using a combination of a screened-grid valve and a specially designed transformer having a resonance generally below 7,000 cycles. Several units, *i.e.*, valve and transformer, are wired in cascade to obtain the required correction and the output to the land-line is taken from a power valve as in standard repeaters. An intensity control is included in the design of the amplifier although the cable output will not vary considerably. Data obtained from measurements on an existing amplifier show that a voltage amplification of about 5 million at 2,000 cycles is within the compass of the apparatus. An even more remarkable feature, however, is that this figure is 40,000 times as great as the amplification at the lower end of the telephone frequency range (250 cycles). Repeaters used hitherto on land lines in 2-wire and 4-wire systems have voltage amplifications of 30 and 900, respectively, at 2,000 cycles.

At the transmitting end of the cable the received currents from the land line pass into a special shaping amplifier where the amplification increases rapidly with frequency so as to give a "shaped" input to the cable, this again being effected by means of the electrical combination already mentioned. The overall voltage amplification (in terms of "power amplification" this figure is 10^{10}) of the terminal apparatus—transmitter and receiver—is of the order of 10^8, which figure is unique in connection with cable telephony.

The preceding data have been taken from the specification of a patent recently granted to Dr. N. W. McLachlan and Mr. W. S. Smith.

"Exporting" Power from Switzerland.

In the last issue of the *Schweizer Industrie und Handel*, Mr. H. Demierre gives some interesting details of the growing "exportation" of electric power from Switzerland, which increased from 377 million kWh in 1920 to 1,034 million kWh in 1928. The author states that the export consists really in renting to foreign buyers a certain share of the power obtained from Swiss generating plant. Up to the end of 1928 the share available, by legal authorisation, from Swiss electricity stations for foreign utilisation amounted to 312,988 kWh, and was divided among various European countries in the following proportions:—Germany, 18 per cent.; France, 39 per cent.; Italy, 30 per cent.; and territory as yet undetermined, 30 per cent. Public opinion in Switzerland was again aroused last year by the operations of several foreign electrical enterprises which, according to the report of the Swiss Federal Water-Power Department, were endeavouring to set up hydro-electric stations in Switzerland to be financed, constructed, and entirely run by themselves for purposes of power exportation. In order to anticipate any possible danger of the internationalisation of a national wealth, the Federal Authorities decided, with the consent of Swiss producers and distributors of electrical energy, to determine the conditions authorising the construction of plant intended chiefly for power exportation, *viz.*, that Switzerland, and more particularly its producers of electrical energy, shall occupy permanently a predominant position as regards the administration and financing of the plant in question; the export of electricity at the price of production is forbidden; in case of prolonged drought, Switzerland is to be granted the possibility of utilising a part of the energy intended for exportation to cover its own needs; after a period of 20 years foreign participation may be cancelled, and the enterprises may be run, if necessary, exclusively to supply the Swiss market. Generally speaking, the Federal Authorities consider it is preferable to leave the management of Swiss exports of electricity to plant which, first of all, regularly supplies the Swiss market, rather than to concerns built purposely for exportation, in which case foreign influence and policy would be extremely difficult to detect.

Further, if properly regulated, exports may lead to combinations resulting in the mutual advantage of both countries. In this connection Mr. Demierre cites the case of the international negotiations in connection with a projected power station at Dogern, on the Rhine. The total Swiss share (54 per cent.) of the energy produced by that plant having been the object of a request for exportation in favour of the Rheinisch-Westfalische Elektrizitatswerk at Essen, the cantons of Basle-Town and Basle-Country expressed the desire to control the German share of the energy produced by another future international plant on the Rhine at Birsfelden, in return for the corresponding cessation of a right of option on the Dogern, or any other international Rhine plants' Swiss production. This request closely coincided with a proposition made by the State of Baden with a view to exchanging its share at Birsfelden against a corresponding amount of Swiss energy derived from the Dogern plant. As the Swiss share of the annual production at Dogern should attain a yearly average of 238.4 million kWh, and that of Baden at Birsfelden 144.6 kWh, the exchange of equal quantities of electrical energy would leave to Switzerland a bonus of 93.8 million kWh, *i.e.*, 21 per cent. of the energy produced by the Dogern plant.

Finally, Mr. Demierre mentions that the Swiss Federal Department for the Development of Water Power has adopted such a comprehensive system of statistics with regard to the technical and economic conditions of the Swiss hydro-electric industry that it is not only possible to calculate the exact amount of power obtainable from any given volume of water, but to make also an accurate estimate of the power which can be derived from artificial or natural water-basins. Further, statistics indicate at the end of each month the exact amount of energy produced during the preceding month, and determine the proportion of its utilisation within, as well as beyond, Swiss boundaries.

Industrial Lighting and Power Relationship.

The *Electrical World* gives the following table of lighting and power factors as the result of a comprehensive survey of twenty large and small industrial plants of various kinds:—

	Per Cent
Ratio of power to connected load	68.5
Ratio of light to connected load	31.5
Ratio of power demand to total demand	61.0
Ratio of light demand to total demand	39
Ratio of power demand to power connected load ...	48.7
Ratio of light demand to light connected load ...	65.8
Ratio of power kilowatt-hours to total kilowatt-hours	64.3
Ratio of light kilowatt-hours to total kilowatt-hours	35.7
Ratio of power revenue to total revenue	63.0
Ratio of light revenue to total revenue	37.0

Brass Annealing Furnaces.

Assumed data: (1) weight of charge, 8,000 lb. of brass; (2) temperature, 1,100 deg. F.; (3) weight of pans, 850 lb.; (4) total time for anneal, 1½ hours; (5) size of furnace, 6 ft. 6 in. wide by 17 ft. long by 2 ft. 6 in. high door opening; (6) furnace operated 24 hours per day. Absorption of charge, $8{,}000 \times 0.105 \times 1{,}030/3{,}412 = 252$ kWh; absorption of pans, $850 \times 0.14 \times 1{,}030/3{,}412 = 36$ kWh; stand-by losses (inside area of furnace 375 sq. ft.) $375 \times 1{,}100/10{,}000 = 41$ kWh per hour.

Summary of heat requirements: absorption of charge, 252 kWh; absorption of pans, 36 kWh; losses for 1½ hour $1\frac{1}{2} \times 41$, 62 kWh; total power consumption per charge, 350 kWh.

Performance: 8,000 lb./350 = 23 lb. net per kWh; rating of furnace: $252 + 36/1\frac{1}{2} + 41 = 233$ kW.

Since most of the heat absorbed by the charge must be supplied during the first part of the cycle, the rating of the furnace must be somewhat higher than that determined above. The rating of this furnace should be about 300 kW.

In actual operation a 300-kW furnace operating on 67- and 68-minute anneals at temperatures of 1,000 to 1,100 deg. F. handled from 4,600 to 7,470 lb. of brass product on pans weighing from 540 to 850 lb. with total kilowatt-hour consumptions of from 230 to 294. The output in pounds of brass per kilowatt-hour ranged from 20 to 25.4.—*Electrical World*

State Line Power Station, Indiana.

Information concerning the State Line power station, U.S.A., given in *Power* for December 3rd, supplements the general description included in its issue of October 29th.

This station, which was started up on October 22nd, is chiefly remarkable as containing the largest generating unit anywhere in service, *viz.*, 208,000 kW. The station has been designed for an ultimate capacity of approximately one million kW.

The present set comprises three elements, made up of a 76,000-kW high-pressure turbo-alternator, centrally located, with a 62,000-kW low-pressure turbo-alternator on each side. The additional 8,000-kW is due to the two 4,000-kW, 2,300-volt house generators, one mounted on the shaft of each low-pressure machine. All three elements of the unit operate at 1,800 r.p.m. and generate 3-phase 60-cycle current at 22,000 volts. The high-pressure prime mover is a 17-stage single-flow impulse turbine. Each low-pressure turbine is of the double-flow type, with 11 stages on either side of a central admission. Steam enters the turbine at 600 lb. per sq. in. and 730 deg. F. The performance diagram, made up for a load of 150,000 kW on the triple unit, shows a heat consumption of 13,420 B.t.u. per kWh. For feed-water heating there are five points of extraction, and the feed-water enters the boiler-feed headers at 380 deg. F. Loss of vacuum closes valves between the high- and low-pressure turbines. The six boilers of the initial installation have a maximum capacity of 450,000 lb. per hour. They are fired by pulverised fuel, and have full water-cooled furnaces.

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The Electrical Association for Women.

On December 11th a large party of members of the Electrical Association for Women visited the London showrooms of Messrs. Berry's Electric (1928), Ltd., where a short talk on electric cooking was given by Mrs. A. Mole, and a lecture on water heating by Mr. Painton. Members were keenly interested in both these very important subjects, and there was a good discussion.

Wayleaves in Ireland.

According to the *Irish Electrician* the Ministry of Commerce for Northern Ireland has prescribed the following annual rentals (under Section 22 of the Electricity Supply Act, 1919) in respect of each double pole :—

(1) the sum of eight shillings per pole which impedes ploughing operations;

(2) the sum of four shillings per pole which impedes the mowing of grass;

(3) the sum of two shillings per pole in other cases;

(4) the sum of sixpence per stay.

It is pointed out that these terms are much more favourable than those to which the Central Electricity Board has had to agree in England and Scotland.

It is thought that in the Free State the general position is much simpler and probably a great deal more satisfactory from every point of view in the long run. The State has taken the fullest powers to erect its lines and apparatus anywhere. It is expected that as a consequence of a combination of absolute power and personal tact, the cost of the Free State transmission and distribution lines will be a great deal less than the cost of equivalent lines in Great Britain and Northern Ireland.

It was stated in the Dáil last session that the original intention to pay an annual wayleave rental on transmission pole sites had been superseded by the outright purchase of the sites. Hence the Electricity Supply Board when it takes over the scheme will have to pay interest on the money now capitalised for the purchase of the pole sites, instead of paying a perpetual yearly rental to the individual owners of the land on which the poles are placed. The capitalised value of the proposed rentals would presumably have been larger than the total amount now to be paid for the sites. The method possesses another advantage in that the Supply Board in due course will amortise its debt to the State, and thenceforward will hold the sites free of all charge.

Savoy Hotel and Theatre Lighting.

A discussion on the above subject took place at a meeting of the Illuminating Engineering Society recently held in the lecture theatre of the Home Office Industrial Museum, London, the chair being occupied by the president (Dr. J. W. T. Walsh, of the National Physical Laboratory, Teddington).

Mr. HOWARD M. ROBERTSON, M.C., F.R.I.B.A., said that in England architects had not taken full advantage of the technical resources of the electrical trades, nor of the advice that was at their disposal. On the Continent he felt they were still much ahead of England in dealing with the problem of internal and external lighting. With regard to the lighting of the Savoy Theatre, London, which installation had been carried out by himself and his partner, their object had been to get an effect of sunlight without glare, so that the audience might have that feeling of comfort that the sun imparted. To do so the light had to come from above, but without casting shadows, and after various experiments had been carried out they had found that it could be done by reflecting light at various angles, so that it hit the gilded surfaces of the walls and shone off them on to the people. The lights above the upper balcony, however, were kept cool in tone, as that part of the theatre was apt to be hot in itself; there they had a blue ceiling, and had cast light directly upon it. The front part of the ceiling was coffered, open, below the lamps, which were concealed on the audience side of each square and cast their light on to reflectors above each square, which again reflected the light down and on to the side walls. The reflectors were originally white stove enamelled, but produced too great a glare, so they had covered them with gold paint, thus making the light colour effect perfect for their purpose. That light was aided in the forepart of the house by a string of lamps round the front of the balconies, that strip being concealed in a plaster trough; the balcony front above it being gold, the reflected light was sunny. All the walls being gold and shining, they picked up light from everywhere, and there were no dark corners. They had no electrical fittings as ornaments in the front of the house, but in the corridors and bars they had some quite simple ones made of glass.

Mr. BASIL IONIDES said that, with the exception of a few isolated signs and shelters, London offered very little æsthetic pleasure in the external lighting of its buildings, and enterprise seemed to have stopped short at flood-lighting and the use of neon tubing, which was, however, used for the most part without taking advantage of its charming possibilities. In the lighting of the new approaches to the Savoy Hotel and the Savoy Theatre fronts, the designers had attempted to employ lighting as a more definitely architectural and decorative element; but at the Savoy the problem was complicated by the proximity of hotel and theatre. Too many lighting schemes, both here and abroad, were unsightly in daylight, which remark was particularly true of designs in which the naked bulb was exposed, or in which neon-tube effects were coarsely contrived. The French had been very successful in the latter field, and had "spotted" the mechanism of the tubing in such a way as to contribute to the general design.

The Savoy scheme was based upon the covered approaches and the idea of leading people towards the hotel and theatre, achieving some sort of a climax in the courtyard; to this end the lighting effects were carefully considered, but suggestions for treating the actual hotel front were not yet realised, so that the ensemble was, therefore, incomplete. The lighting of the shelters was by a series of closely-spaced bulbs on the outer edge of the outfit, concealed in "V"-shaped troughs of flashed opal glass.

The courtyard had been fitted with new rectangular hanging light boxes, which would possibly require less current and upkeep than trays or fittings of a complex design. The theatre front's main feature was a sign, consisting of large projecting wood letters. The theatre signs, five in number, were an interesting feature of the scheme; two employed "Ascog" cubes, and one was a flash sign with changing colours.

Fatalities.

George Taylor (58), of Morley, Yorks., received a fatal electric shock on December 6th while working in the dye-house of Messrs. Charles Scarth Bros., Ltd. He went to turn off the switch of a hydro-extractor and received a shock at 400 V.

An inquest was held at Bradford on December 17th on Arthur Illingworth (38), who received a fatal electric shock whilst repairing a defect in the flex connected with an electric iron at his home. The widow stated that almost immediately after her husband had gone into the scullery she heard a noise, and found him apparently dead. The inquest was adjourned.

Feeder Protection.

The figures accompanying the comparison between the effectiveness of the Merz-Price and the Metroplitan-Vickers Co.'s "Translay" protective systems, which appeared in our issue of December 6th, under the title of "Feeder Protection," might appear to indicate that the currents circulate in the secondary windings. As stated in the text, however, such currents are in opposition.

Institution of Electrical Engineers.

MEMBERSHIP CHANGES.—The December issue (Vol. 68, No. 396) of the Institution *Journal* contains a list of the members who have been transferred from one class to another according to the provisions of new Bye-laws 15 to 18.

WESTERN CENTRE DINNER.—The annual dinner of the Western Centre of the Institution is to be held at the Royal Hotel, Cardiff, on January 13th. Tickets will cost 10s. 6d. each, exclusive of wines, and ladies are again specially invited.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

At a recent meeting of the Stoke-on-Trent Electricity Committee it was agreed that the employés of the Department should be transferred to the North-West Midlands Joint Electricity Authority with effect from April 1st next. The Committee considered the duties and responsibilities of the city electrical engineer, and it was unanimously resolved that while Mr. C. H. YEAMAN remained in the service of the Corporation, no alteration should be made in his status and that his remuneration should remain as at present.

The Sunderland Town Council has appointed Mr. A. B. MACLEAN, Newcastle, as chief assistant in the electricity undertaking at a salary of £800 per annum. A motion to advertise the position was negatived. Mr. MacLean is a partner in the firm of Mountain, Wood & MacLean, consulting engineers. He was educated at Glasgow University, and after serving with the British Thomson-Houston Co., Ltd., was with the Newcastle-upon-Tyne Electric Supply Co., Ltd., for about nine years.

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Mr. BERNARD C. HOLDING, editor of *The Electrician*, has resigned the editorship to take up an appointment with the International Standard Electric Corporation, London, on January 1st.

The Southend-on-Sea Town Council has appointed Mr. A. C. JOHNSON, as borough electrical engineer in succession to Mr. R. Birkett as from October 1st, at a salary of £1,000 per annum for the first two years, rising by two annual increments of £100 to a maximum of £1,200. Mr. Johnson has been acting borough electrical engineer since March 22nd last, when Mr. Birkett was first granted sick leave.

The Aylesbury Town Council has appointed Mr. F. BENT, Bolton, as works superintendent at the electricity works.

The Barnes Urban Council has appointed Mr. BULLPITT to succeed Mr. G. C. Law, who has been appointed deputy electrical engineer and manager at Hammersmith, as assistant electrical engineer and station superintendent.

Mr. WOOD DEANE SNAPE, who, as reported in our "Business Notes," has taken over the business of L. Andrew & Co., Manchester, started his career in 1890 with the Silvertown Co. When Mr. L. Andrew relinquished the position of Manchester branch manager of the company in 1893, to commence business on his own account, Mr. Snape joined him, and their association was maintained up to the time of Mr. Andrew's death in December last year, when Mr. Snape became joint administrator of his estate.

Mr. C. HIGHAM, of Blackburn, who recently resigned from the council of the Municipal Tramways and Transport Association, of which he is a past president, has been elected an honorary member in recognition of his services. He was formerly chairman of the Blackburn Tramways Committee.

The Islington Electricity Committee has appointed Mr. JOHN W. A. PHEASANT, of Grimsby, as assistant and relief charge engineer, at £297 per annum.

The Redcar Town Council has increased the salary of the borough electrical engineer to £350 a year.

The chief officials of Oldham Corporation and the Tramways Committee have presented a standard lamp and shade and a cut glass rose bowl to Mr. C. JACKSON, late general manager of the tramways, who has left for Plymouth. The members of the Tramways Committee also presented him with a case of fish servers and eaters.

Mr. CHARLES FURNESS, borough electrical engineer and tramway manager, Blackpool, returned to his duties on December 16th, after his honeymoon tour in Italy. He was heartily welcomed by members of the Transport Committee. On December 19th, the works and administrative staffs presented Mr. Furness with a silver cigarette box, Mr. W. W. Parkinson performing the ceremony.

Obituary.—Dr. W. ROLLINS.—We have received from Dr. Samuel W. Ellsworth of Boston, U.S.A., an appreciation of the late Dr. William Rollins, of Boston, who died on October 18th, at the age of 77 years. One of the pioneers in the study of Roentgenology, following Professor Roentgen's epoch-making discovery in December 1895, Mr. William Rollins became one of the foremost investigators of that period by his contributions to the literature on X-rays. He foresaw the far-reaching benefits which Roentgen's discovery was destined to give to medicine, and in the new field thus offered, he pursued his investigations. Numerous reports of his research and experiments appeared in various medical and scientific journals, and he published them in book form in 1904 under the title of "Notes on X-light." He visualised not only the future value of the X-rays in medicine and gave directions for their use, but also realised the danger attendant upon the misuse of this powerful agent and prescribed safety methods for the operator and patient. During the year 1900 he made experiments with radio-active substances, which led him to believe in the value of radium as a therapeutic agent. He established a generous research foundation at the Smithsonian Institution, Washington, B.C.

Dr. Rollins was a frequent contributor to the ELECTRICAL REVIEW during his investigations on X-rays and radium, between the years 1894 and 1899, and many of these investigations were subsequently incorporated in his book.

Mr. G. ARCHER.—The Dublin Press reports the death, on December 6th, of Mr. Gilbert Archer, M.I.E.E., deputy city electrical engineer of Dublin. Mr. Archer was born in London in 1866 and was educated at Finsbury Technical College. He entered the service of the Dublin Electricity Department upon its inception in 1892.

Wills.—Sir H. A. KIRK, late director-in-chief of the Indo-European Telegraphs, left £3,217 gross and £3,011 net personalty.

The late Mr. ALFRED BAKER, general manager of the Birmingham Corporation Tramways Department, left estate valued at £17,180 (£15,790 net personalty).

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

J. M. Pirie & Co. (London), Ltd.—Private company. Registered December 14th. Capital, £6,000 in £1 shares (5,000 7 per cent. cumulative preference and 1,000 ordinary). Objects:—To acquire the business of architectural metal workers carried on by J. M. Pirie & Co., Ltd., and/or N. T. Helme, and to carry on this and the business of manufacturers and designers of electric lighting fittings, lock manufacturers, brass founders, &c. The directors are:—N. T. Helme, 107, Beaufort Street, Chelsea, S.W.3; I. B. M. Pirie, address not stated; E. D. N. Pentecost, 31, Laleham Road, Catford, S.E.6. Secretary: E. D. N. Pentecost. Solicitors: Stow, Preston & Lyttelton, 12, Lincoln's Inn Fields, W.C.2.

Mycalex (Parent) Co., Ltd.—Private company. Registered December 12th. Capital, £25,000 in 10s. shares. Objects:—To acquire certain patents and the trade mark "Mycalex" used in connection therewith; to adopt an agreement with Hoare, Miller & Co. (owners of the said trade mark), the Brindaban Industrial Syndicate, Ltd., and E. H. Kinnard, whereby it is agreed, *inter alia*, to transfer the trade mark and the benefit of certain agreements relating thereto, and to carry on the business of manufacturers of, and dealers in mica "Mycalex," and all kinds of insulating material, metal merchants and contractors, ironmongers, electrical engineers, &c. The subscribers (each with one ordinary share) are:—A. H. Freeman, secretary, and A. Parker, cashier, both of 5, Holborn, E.C.1. The first directors are:—E. H. Kinnard, Capt. E. R. D. Hoare, and Sir Herbert Ingram, Bt. (all permanent) Solicitor: F. P. Woodcock, 5, Holborn, E.C.1.

Pembrokeshire Electrical Power and Distribution Co., Ltd.—Private company. Registered December 14th. Capital, £100 in £1 shares. Objects:—To carry on the business of suppliers and distributors of electricity in all its branches. The provisional directors are:—A. L. Davis, 51, Mansel Terrace, Swansea, clerk; Violet Daniel, 10, Verig Street, Manselton, Swansea, clerk. A. Bremner signs documents as manager (*pro tem.*). Qualification (of subsequent directors), £10. Solicitor: J. E. M. Crowther, 15, Abingdon Street, S.W.

Battery Services, Ltd.—Private company. Registered December 16th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of manufacturers and repairers of, and dealers in automobiles, motor cars, motors and cycles, magnetos, dynamos, and all electrical equipment, &c. The permanent directors are:—W. H. Oliver, "Fellsyde," Manor Grove, Benton Park Estate, Newcastle-on-Tyne; T. Armstrong, Dene House, Ellison Place, Newcastle-on-Tyne; G. H. Patterson, address not stated. Registered office: 98a, New Bridge Street, Newcastle-on-Tyne.

Electro-Gas Camshafts, Ltd.—Private company. Registered December 19th. Capital, £10,000 in 9,000 8 per cent. cumulative preferred ordinary and 1,000 ordinary shares of £1 each. Objects: To acquire inventions relating to camshafts of all kinds or the process of electro-gas welding, &c., and to adopt an agreement with Westminster Securities, Ltd. The provisional directors are: T. M. Wechsler, The Mount, Shortlands, Kent, solicitor; S. H. E. Bunley, 38, Kingswood Avenue, N.W.6, articled clerk. Qualification: £250 shares. Solicitors: Kenneth Brown, Baker, Baker, Essex House, Essex Street, W.C.2.

Magenerator, Ltd.—Private company. Registered December 18th. Capital, £525 in 500 8 per cent. cumulative preference shares of £1 each and 500 ordinary shares of 1s. each. Objects: To carry on the business of manufacturers, repairers, importers and exporters of and wholesale and retail dealers in

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magnetos, dynamos, self-starters, and other electrical equipment for mechanically-propelled vehicles or other purposes, &c. The directors are: F. H. McCardie, The Bungalow, Much Hadham, Herts. (director New Nimrod (1927), Ltd., and other companies); F. R. Woods, 215, Balfour Road, Ilford; W. E. G. Woods, 89, Wellesley Road, Ilford. Qualification: £1. Secretary: W. E. G. Woods. Registered office: 24, White Lion Street, Bishopsgate, E.C.

Tree-Top Electrical Services & Supplies, Ltd.—Private company. Registered December 17th. Capital, £2,000 in £1 shares. Objects: To carry on the business of electrical engineers, contractors, mechanical and general engineers, &c. The subscribers (each with one share) are: A. Miller, 23, Kennedy Drive, Glasgow, clerk; F. V. Cheshire, 226, Woodlands Road, Glasgow, electrical engineer. The first directors are not named. Registered office: 46, Gordon Street, Glasgow, C.1.

Official Returns of Electrical Companies.

Western Counties Electrical and Engineering Co., Ltd.—Capital, £6,000 in 3,000 preference and 3,000 ordinary shares of £1 each. Return dated July 11th, 1929. 2,015 preference and 2,026 ordinary shares taken up. £1,211 paid on 611 preference and 600 ordinary shares. £2,830 considered as paid on the remainder. Mortages and charges at date of return, nil. Since registered: Mortgages dated September 21st and 23rd, 1929, to secure £3,000 and £350, respectively.

A. Cunningham & Co. (Manchester), Ltd.—Capital, £4,000 in £1 shares. Return dated July 25th, 1929. 1,057 shares taken up. £586 paid (being £1 per share on 537 shares and 4s. per share on 500 shares). £20 considered as paid on 20 shares. £51 calls unpaid. Mortgages and charges, nil.

E. H. Millington & Co., Ltd.—Capital, £2,000 in £1 shares. Return dated August 26th, 1929. 752 shares taken up. £752 paid. Mortgages and charges, nil.

Culm Valley Electric Supply Co., Ltd.—Capital, £50,000 in 20,000 preference and 30,000 ordinary shares of £1 each. Return dated August 23rd, 1929. 1,000 preference and 15,490 ordinary shares taken up. £10,900 paid. £5,590 considered as paid. Mortgages and charges, nil.

National Electric Construction Co., Ltd.—Capital, £125,000 in 10s. shares. Return dated June 6th, 1929. 170,000 shares taken up. £75,574 10s. paid on 151,149 shares. £9,425 10s. considered as paid on 18,851 shares. Mortgages and charges, £75,000.

Madras Electric Supply Corporation, Ltd.—Capital, £800,000 in 473,200 ordinary and 326,800 preference shares of £1 each. Return dated June 26th, 1929. All shares taken up. £694,000 paid on 420,400 ordinary and 273,600 preference shares. £106,000 considered as paid on 52,800 ordinary and 53,200 preference shares. Mortgages and charges, £182,100 7 per cent. second (registered) debentures.

British Arc Welding Co., Ltd.—Capital, £50,000 in £10 shares. Return dated August 14th, 1929. 1,474 shares taken up. £12,740 paid. £2,000 considered as paid. Mortgages and charges, nil.

Wantage Electric Supply Co., Ltd.—Capital, £6,000 in 600 cumulative preference shares of £5 each and 3,000 ordinary shares of £1 each. Return dated July 10th, 1929. 240 preference and 2,202 ordinary shares taken up. £3,402 paid. Mortgages and charges, nil.

Wholesale Electric Lamp Co., Ltd.—Capital, £1,500 in £1 shares. Return dated August 22nd, 1929. All shares taken up. £1,500 paid. Mortgages and charges, nil.

Pettigrew & Merriman (1925), Ltd.—Capital, £250,000 in 125,000 preference shares of £1 each and 500,000 ordinary shares of 5s. each. Return dated September 13th, 1929. 125,000 preference and 435,600 ordinary shares taken up. £202,650 paid (being 15s. per share on the preference and 5s. per share on the ordinary shares). Mortgages and charges, nil.

W. Sisson & Co., Ltd.—Capital. £50,000 in 5,000 preference, 38,000 ordinary, and 7,000 deferred shares of £1 each. Return dated July 30th, 1929. 4,375 preference, 31,711 ordinary, and 7,000 deferred shares taken up. £28,686 paid on 4,375 preference and 24,311 ordinary shares. £14,400 considered as paid on 7,400 ordinary and 7,000 deferred shares. Mortgages and charges: Overdraft limit with Lloyd's Bank, Ltd., £15,000, but account was in credit at July 30th, 1929.

Clark & Moir, Ltd.—Particulars filed of £5,000 debentures authorised October 23rd, 1929, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £500.

Cleethorpes Radio Supply, Ltd.—A. J. Weaver, 77, Victoria Street, Grimsby, was appointed receiver on November 22nd. 1929. under powers contained in mortgage debentures dated April 23rd, 1923, and May 1st, 1929.

West Cambrian Power Co., Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated December 3rd, 1929, to secure all moneys due or to become due from the company to Barclay's Bank, Ltd.

Electro Dynamic Construction Co., Ltd.—Satisfaction in full (1) on November 7th, 1929, of four debentures authorised October 22nd, and registered October 28th, 1924, securing £250 each, and (2) on November 14th, of deposit of deeds with Barclay's Bank, Ltd., dated June 10th and registered June 18th, 1929.

Oriental Telephone & Electric Co., Ltd.—Satisfaction to the extent of £3,595 on December 10th, 1929, of debenture stock covered by trust deed dated June 28th, 1905, and supplemental deed dated June 12th, 1927, and registered July 11th, 1905, and July 20th, 1907, respectively.

General Electric Co., Ltd.—Satisfaction to the further extent of £232,580 on or before November 4th, 1929, of trust deed dated July 22nd, and registered July 26th, 1921, securing £3,500,000 mortgage debenture stock.

British Horo-Electric, Ltd.—Agreement dated December 6th, 1929, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. Bingguely, 77, Rue du Nord, La Chaux de Fonds, Switzerland.

Wm. Feather & Sons, Ltd. (formerly Electric Transport (Nelson), Ltd.).—Mortgage for £1,219 16s. 1d., dated October 26th, 1922, charged on eight houses in Varley Street, Colne (being property acquired by the company on November 23rd, 1929). Registered pursuant to Section 81 of the Companies Act, 1929. Mortgages: Bingley Building Society.

City Notes.

Allen West & Co., Ltd.

The annual meeting of this company was held on December 19th, Mr. A. E. C. Slazenger (chairman) presiding. In presenting the report and accounts the chairman said the net profits amounted to £29,291, as compared with £24,224 in the preceding year. The twelve months covered by the accounts had shown the largest increase in turnover yet experienced by the company, and the orders in hand were 2½ times as large as at the date of the last balance sheet, notwithstanding the largely increased output which had been obtained. This increase was mainly in export business, where, contrary to the experience of the large electrical companies, better prices had been obtainable than in the home market. During the year the whole output of the company's new products had been sold on the Continent, as, owing to the rapid increase of the Continental demand, it had been impossible to allot any output to the home market. In view of this the company had bought the Government factory at Woolston and 83 acres of freehold land on terms which involved considerably less capital expenditure than the erection of a new factory. These buildings were ideal for the production of the company's heavier products, the space for which was limited in the present factories. They looked forward with the greatest confidence in view of the increasing recognition of the quality of the company's products for important users both at home and overseas. Before terminating the proceedings, he had a resolution to propose which afforded him very great pleasure, and that was to ask the shareholders to give a special vote of thanks to Mrs. Allen West for the very valuable work which she had rendered, without any charge, on behalf of the staff, which he could assure the shareholders had been much appreciated, especially by the female staff. The resolution was seconded by Mr. O. F. Best, a director, and carried amidst applause. Mrs. Allen West, in reply, said she was greatly surprised at the extraordinary amount of gratitude which was displayed by the employés for the slightest amount of help and attention. She paid a high tribute to the work of the staff and the *esprit de corps* which existed. The report and accounts were adopted.

Venezuela Telephone and Electrical Appliances Co., Ltd.

The annual meeting of this company was held on December 17th. Mr. H. S. Bennett, who presided in the absence of the chairman (Sir Alexander Roger), said that the past year was a particularly strenuous one for all the staff in Venezuela, as, apart from the increased work on the maintenance, traffic, and commercial sides contingent upon the normal growth of the company's business, much had been accomplished on capital account. The capital expenditure during the year was approximately £85,000, the largest sum spent in any one year since the inception of the company. When the 2,000 automatic lines now being installed in Caracas were completed, 8,000 lines would be connected to the Caracas exchange. The introduction of the automatic system had been a pronounced success, and further development of the Caracas and other neighbouring areas was

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anticipated and planned for. It was expected to extend the automatic facilities to the towns of Maracay, Valencia, La Geraira, and Puerto Cabello. The authorities had consented to an increased tariff. At June 30th last subscribers numbered 9,465, an increase of 750 during the year. With the provision of additional plant facilities and by means of propaganda, he believed that a much larger rate of growth would be possible in the future. Their relations with the Government authorities were most friendly, and their co-operation was warmly appreciated by the local management and the Board. Mr. Wallis was relinquishing his position as active manager of the company, but had agreed to act in an advisory capacity. His successor was Mr. Vegas, formerly second in command. The report and accounts were adopted.

Cape Electric Tramways, Ltd.

Presiding at the annual meeting on December 18th, Mr. L. Breitmeyer said that during the period under review no change for the better had taken place as regarded motor-'bus competition, which had considerably increased. The traffic returns showed that in Cape Town the tramways carried 1,377,967 passengers fewer than in the preceding year, with a decrease in receipts of £19,644. In Port Elizabeth, there was an increase of 741,421 passengers. In the aggregate, 42,251,336 were carried, as against 41,493,331 in the preceding year, and the receipts were £444,185, as compared with £438,071. At the moment no change as regarded the control of passenger transport by the authorities had taken place, and the company was therefore still subjected to unfair competition. The Provincial Council, had, however, recently passed legislation giving wider powers to municipalities for the control of transport, and a Commission appointed by the Government had now practically completed its investigation upon the best means of dealing with the present uncontrolled road competition. It was expected that it would place its report before the Government before the end of the current year. In view of the legislation that had been passed, the outlook of the company was more encouraging than it had been for some time past. The report and accounts were adopted, and a resolution altering the articles of association to enable the control, management, and direction of the company to be transferred to South Africa, was also approved.

Stock Exchange Notices.

Dealings in the following have been allowed by the Committee, under Rule 159:—

Low Temperature Carbonisation, Ltd.—110,409 ordinary shares of 2s. each fully paid, Nos. 8,892,932 to 9,003,340.

Northampton Electric Light & Power Co., Ltd.—£114,000 new 5 per cent. debenture stock, issued at £93 per cent., fully paid.

County of London Electric Supply Co., Ltd., 1,106,795 new ordinary shares of £1 each issued at 36s. per share, partly paid and fully paid, Nos. 6,820,385 to 7,937,179.

The undermentioned have been ordered to be officially quoted.

Davis and Timmins, Ltd.—40,000 6½ per cent. cumulative preference shares of £1 each fully paid, Nos. 110,001 to 150,000.

Underground Electric Railways Co. of London, Ltd.—5,313 ordinary shares of £1 each fully paid, Nos. 7,278,273 to 7,283,586.

Ceara Tramway, Light, and Power Co., Ltd.

The net revenue for the year ended June 30th was £28,147 (against £27,572 in 1927-28). After meeting debenture interest and again transferring £12,500 to reserve, the dividend is maintained at 5 per cent. free of tax, and £8,832 is carried forward. The report mentions the adverse effect of motor 'bus competition upon the tramway undertaking, which, however, was offset by increased sales of electricity and greater receipts from the company's own omnibuses. The increased demand for power necessitates the extension of the plant, and a complete unit, doubling the present effective capacity, is to be ordered. It is hoped to finance this without an issue of new capital. The death of Mr. C. Hunt, a director, is recorded.

Yarrow & Co., Ltd.

Mr. H. E. Yarrow, C.B.E. (chairman), presiding at the annual meeting on December 18th, said that depression and severe competition still prevailed in the shipbuilding industry, and it was considered advisable to carry forward the small profit which had been earned. In addition to large orders from shipping companies, the Yarrow boiler was now being extensively used in land power stations. Pulverised fuel developments were being closely watched, and recently a high-pressure boiler fitted with the company's pulverised fuel system had been installed at the works, providing a practical demonstration of the system.

Southern Canada Power Co.

The report of the company for the fiscal year ended September 30th shows steady expansion. The gross earnings were $2,095,912, as compared with $1,809,566 for the previous year. The net earnings, after deductions for interest and depreciation, were $791,792, as against $674,074, and after payment of dividends the surplus for the year amounted to $104,469, as compared with $68,097; this is added to the surplus brought forward of $234,818, making a total of $339,281 to the credit of the profit and loss account.

Companies Struck Off the Register.

The names of the undermentioned companies have been struck off the Register, and they are thereby dissolved:—

"Daisy" Vacuum Cleaner Co., Ltd.
Electric Car and Accessories Co., Ltd.
Farad Electrical Co., Ltd.
Insulated Cap and Rivet Co., Ltd.

Official Notice *re* Companies.

The names of the undermentioned companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—

Dartmoor Electric Supply Co., Ltd.
Magneto and Spare Part Co., Ltd.
Napier-Kimber, Ltd.
Scholey & Co., Ltd.

Associated Telephone and Telegraph Co., Ltd.

The following quarterly dividends have been declared, payable on January 1st:—

Seven per cent. first preferred stock, quarterly dividend of $1.75 per share; $6 first preferred stock, quarterly dividend of $1.50 per share; class "'D"' stock, quarterly dividend of £1.00 per share; class "A" stock, quarterly dividend of $1.00 per share, plus an additional and participating dividend of 25 cents on class "A" stock.

Agricultural and General Engineers, Ltd.

The receipts for the past year declined from £90,309 to £53,496, the receipts from subsidiary companies having fallen from £69,531 to £33,902. After meeting expenses there remains a balance of £1,038 (against £35,840) which is added to the balance of £56,445 brought in, and the total (£57,483) is carried forward.

Mann, Egerton & Co., Ltd.

The report for the year ended September 30th records a net profit of £24,335, as compared with £30,674 in 1927-28. After meeting the preference dividend, the directors propose to allocate £7,510 to the service of funding certificates and to carry forward £10,302. In view of the difficulties of the period the result is considered to be "not unsatisfactory."

Calcutta Electric Supply Corporation, Ltd.

A special meeting of shareholders has been called for January 10th for the purpose of considering alterations to the company's articles of association. Some of these alterations are necessitated by the new Companies Act, but the directors also propose to restrict the holdings of foreigners to 20 per cent. of the whole share capital.

British Vacuum Cleaner and Engineering Co., Ltd.

The accounts for the year ended September 30th show a net profit of £6,638. From this a debit balance of £5,099 brought forward is deducted, leaving £1,539 to be carried to the next account.

Victoria Falls and Transvaal Power Co., Ltd.

The directors have declared an interim dividend of 3 per cent. on the preference shares, together with a further 3 per cent. in respect of participating rights. The ordinary shares are to receive 3 per cent.

Eastern Telegraph Co., Ltd.

The dividend on the preference stock for the quarter ending December 31st (at the rate of 3½ per cent. per annum), is to be paid on January 18th.

Northern Mexico Power and Development Co.

A dividend of 1¾ per cent. has been declared on the preference stock and 1 per cent. on the common stock, payable on January 2nd.

Brazilian Traction, Light and Power Co.

The regularly quarterly dividend of 50 cents per share has been declared on the ordinary shares. It is also proposed to pay a stock dividend of 1 per cent. on the ordinary shares.

Electric and General Investment Co., Ltd.

An interim dividend of 5 per cent. has been declared on the ordinary shares.

Montreal Light, Heat and Power Co.

A quarterly dividend of 60 cents per share has been declared.

Greenwood & Batley, Ltd.

The interim dividend is again 2½ per cent.

Stocks and Shares.

In consequence of the slackening of business on the Stock Exchange as the Christmas Holidays approached, and to the vacation period clashing this year with our usual printing time, our "Stocks and Shares" feature is withheld this week. At the time of going to press, depression in industrial securities continues owing to the effect of recent developments in both London and New York. The Exchange closed on Tuesday afternoon, and remains so on the day of issue of this number of the REVIEW.

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Our Foreign Electrical Trade.

Electrical Exports and Imports during November.

IT was to be expected that there would be a reaction in November following the high levels reached by both imports and exports in the preceding month. The Board of Trade returns show, however, that this reaction was not great enough to bring either total below the figures for the corresponding month of last year.

The fall of £98,532 in the export total as compared with October was due to very large declines in telegraph and telephone wires and cables, both submarine and non-submarine. Apart from these, there were only three small decreases, all the other items being of larger dimensions. In the machinery section there was actually a net rise of £23,078 and insulated wires and cables showed the fairly substantial gain of £29,613. In comparison with November, 1928, the total showed a rise of £177,451, due mainly to advances in unenumerated goods (£88,505), insulated wires and cables (£81,857), and telegraph and telephone apparatus (£55,443). Opposed to these increases there was a decline of £78,125 in the machinery section, due, as we show below, to smaller shipments to Empire markets. Although the figure for the completed portion of the year shows a net rise of £924,641 as compared with the first eleven months of 1928, this has been entirely due to an advance in exports of electrical goods and apparatus; electrical machinery has registered a decrease of £372,211.

The imports remained at a very high level, exceeded only by the figure reached in the preceding month. The principal features as compared with that month were declines in imports of electrical machinery (£32,264), and of telegraph and telephone instruments and apparatus (£55,443). The increases were not of large dimensions. The total was well above that for the corresponding month of 1928 (£237,889) and the increase was general. Telegraph and telephone apparatus showed the greatest advance (£72,476), but there were also substantial rises in unenumerated goods, glow lamps, meters and instruments, machinery, and batteries and accumulators. There were three decreases but none was of great size. The increase in imports from January to November, as compared with the preceding year, represents about two months' supply.

The re-exports section shows an increase in both comparisons, the principal item being telegraph and telephone apparatus.

The following table shows the distribution of our November exports of electrical machinery, the figures being compared with those for November, 1928:—

Destination.	Nov., 1928. £	Nov., 1929. £	Inc. or dec. £
Europe	87,932	95,962	+ 8,000
Japan	6,040	15,344	+ 9,304
South America ...	46,497	48,936	+ 2,439
South Africa ...	42,058	38,459	− 3,599
British India ...	186,255	92,370	−93,885
Australia	92,731	89,012	− 3,719
New Zealand ...	41,087	30,809	−10,278
Canada	49,569	48,160	− 1,409
Other Countries	100,071	115,063	+14,992
Totals ...	£652,240	£574,115	−£78,125

It is noteworthy that the Empire markets all registered declines while foreign countries increased their share. The continued rise of exports of electrical machinery to European markets is of considerable interest as indicating competitive efficiency in difficult circumstances.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Nov., 1929.	Inc. or dec. as compared with Oct., 1929.	Inc. or dec. as compared with Nov., 1928.	Electrical imports for Nov. 1929.	Inc. or dec. as compared with Oct., 1929.	Inc. or dec. as compared with Nov., 1928.	Electrical re-exports for Nov., 1929.	Inc. or dec. as compared with Oct., 1929.	Inc. or dec. as compared with Nov., 1928.
Electrical goods and apparatus (unenumerated)	£335,721	− £7,610	+ £88,505	£213,077	+ £754	+ £45,429	£9,959	− £1,887	+ £1,300
Insulated wires and cables ...	374,602	+ 29,613	+ 81,851	90,602	+ 2,004	+ 11,373	1,279	+ 47	+ 441
Glow lamps	66,697	− 8,135	+ 16,305	60,750	− 12,375	+ 37,290	1,301	+ 459	+ 516
Arc lamps and parts ...	4 213	+ 672	+ 1,606	2,325	− 5,071	− 509	14	− 10	− 45
Batteries and accumulators ...	96,132	+ 8,400	+ 12,965	132,060	+ 34	+ 20,702	653	− 433	− 603
Meters and instruments ...	33,456	+ 329	− 3,882	53,299	+ 3,398	+ 31,155	697	+ 237	+ 359
Carbons	2,279	+ 1,793	+ 1,734	10,534	− 2,419	− 5,107	77	− 24	+ 8
Switchboards (not telegraph or telephone)	7,395	+ 1,417	+ 2,459	12	− 231	− 639	8	− 4	− 203
Electrical Machinery—									
Electrical machinery (unenumerated)	335,220	+ 5,023	− 28,204	161,190	− 32,264	+ 26,202	13,390	+ 2,119	− 4,928
Railway and tramway motors	19,162	− 3,098	− 17,090	—	—	—	—	—	—
Other motors and generators...	219,733	+ 21,153	− 32,831	—	—	—	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	59,295	− 83,777	− 18,313	2,299	+ 1,851	+ 517	—	—	− 10
Submarine telegraph and telephone cable	30,037	− 68,786	+ 16,903	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	243,106	+ 4,456	+ 55,443	171,524	− 65,432	+ 72,476	11,153	+ 5,806	+ 4,270
Totals	£1,827,048	− £98,532	+ £177,451	£897,672	−£109,751	+£237,889	£38,531	+ £6,310	+ £1,105
	Exports			Imports			Re-Exports		
Inc. for eleven months of 1929	£924,641			£1,671,494			£24,781		

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Minor African Markets.

The Electrical Import Trade of Nigeria, the Gold Coast, Tanganyika, Sierra Leone, Kenya and Uganda.

THE market for electrical goods in West and East Africa is steadily expanding, as will be seen from the following statistics relating to the Gold Coast, Nigeria, Sierra Leone, Kenya and Tanganyika, which have been compiled from official sources. The values for 1928 for all such goods are given below, with comparative figures for 1927 and notes of increases or decreases are added. Some remarkable increases are shown, the purchases of electrical and industrial machinery by the Gold Coast being particularly noteworthy. As to the prospects of future trade generally the official report on Nigeria for 1928 says that the desire for things modern and the money with which to purchase them is spreading quickly throughout the country, while the report on the Gold Coast, although recording a decrease in imports as well as exports, makes the comment that the Gold Coast native has not deprived himself of luxuries. With regard to the scheme for utilising the Pangani River Falls for supplying power to Dar-es-Salaam, Tanga, &c., it was recently stated that the Government of Tanganyika had decided to negotiate with the African General Development Company on the lines of a tender submitted. The sisal-producing companies are expected to be large users of power. General trade in recent months has been rather quiet in both Nigeria and the Gold Coast, largely owing to the weakness in the prices of the principal articles of export, *viz.*, tin, palm products and cocoa. The demand for imported merchandise has consequently slackened. Conditions as a whole in East Africa do not compare favourably with those ruling twelve months ago, except in the building trade.

Imports into Nigeria.

	1927. £	1928. £	Inc. or dec. £
Electrical machinery—			
Total	16,700	14,000	− 2,700
From United Kingdom ...	6,800	7,000	+ 200
,, U.K. Government...	8,600	4,500	− 4,100
,, United States ...	600	500	− 100
,, Germany	600	2,000	+ 1,400
Electrical and telegraphic apparatus—			
Total	36,500	79,000	+42,500
From United Kingdom ...	4,700	11,800	+ 7,100
,, U.K. Government...	27,800	63,000	+35,200
,, Germany	3,300	4,000	+ 700

Imports into the Gold Coast.

Electrical and telegraphic apparatus—			
Total	53,700	73,000	+19,300
From United Kingdom ...	6,400	25,000	+18,600
,, U.K. Government	42,000	43,000	+ 1,000
,, Germany	1,760	1,600	− 160
,, United States ...	2,600	3,000	+ 400
Electrical machinery—			
Total	37,000	58,000	+21,000
From United Kingdom ...	14,000	23,000	+ 9,000
,, U.K. Government	22,000	34,000	+12,000
,, Germany	500	—	− 500
,, United States ...	150	100	− 50
Telegraph and telephone instruments and apparatus —			
Total	3,400	20,500	+17,100
Ditto on Govt. account ...	3,800	10,200	+ 6,400
Engines, steam—			
Total	12,600	17,500	+ 4,900
From Great Britain ...	8,000	14,600	+ 6,600
,, United States ...	2,600	600	− 2,000
,, Germany	1,600	2,200	+ 600
Electric lamps—			
Total	2,100	3,200	+ 1,100
Ditto on Govt. account* ...	60	700	+ 640
Industrial machinery and parts—			
Total	130,000	204,000	+74,000
From United Kingdom ...	104,000	163,000	+59,000
,, India	4,000	2,300	− 1,700
,, Germany	8,000	13,000	+ 5,000
,, United States ...	5,000	22,000	+17,000
Ditto on Govt. account ...	17,000	12,000*	− 5,000
Pumps and pumping machinery—			
Total	12,000	26,000	+14,000
From United Kingdom ...	7,000	9,800	+ 2,800
,, United States ...	2,000	4,800	+ 2,800
,, France	—	11,000	+11,000
Machinery, not specified, other than agricultural—			
Total	33,000	48,000	+15,000
From United Kingdom ...	26,000	45,000	+19,000
,, Germany	4,000	1,000	− 3,000
,, United States ...	2,000	1,700	− 300
Ditto on Govt. account ...	33,000	31,500	− 1,500

Imports into Tanganyika.

Wires and cables, insulated—			
Total	1,700	2,600	+ 900
From United Kingdom ...	1,500	2,200	+ 700
,, Germany	150	350	+ 200
Electrical goods and apparatus, n.e.s.—			
Total	17,800	12,500	− 5,300
From United Kingdom ...	15,000	9,900	− 5,100
,, Germany	2,000	2,200	+ 200
Telegraph and telephone instruments and apparatus—			
Total	3,900	8,200	+ 4,300
From United Kingdom ...	3,800	8,200	+ 4,400
,, Germany	50	—	− 50
Electrical machinery—			
Total	3,900	11,000	+ 7,100
From United Kingdom ...	500	9,000	+ 8,500
,, Germany	3,300	1,200	− 2,100
Steam engines—			
Total	2,600	6,400	+ 3,800
From United Kingdom ...	1,700	3,400	+ 1,700
,, Germany	900	3,000	+ 2,100
Lamps and lanterns—			
Total	14,000	10,000	− 4,000
From United Kingdom ...	1,500	1,600	+ 100
,, United States ...	3,200	1,300	− 1,900
,, Germany	8,700	6,000	− 2,700

Imports into Sierra Leone.

Electrical and telegraphic apparatus—			
Total	21,000	35,000	+14,000
From United Kingdom ...	11,000	28,000	+17,000
,, U.K. Government...	9,000	6,000	− 3,000
Industrial machinery—			
Total	1,400	190	− 1,210
From United Kingdom ...	900	—	− 900
,, U.K. Government...	—	180	+ 180
,, Germany	400	—	− 400
Electrical machinery—			
Total	1,700	1,600	− 100
From United Kingdom ...	—	400	+ 400
,, U.K. Government...	1,700	780	− 920
,, Germany	—	300	+ 300

Imports into Kenya and Uganda.

Electric wires and cables, insulated—			
Total	3,700	13,000	+ 9,300
From Great Britain ...	3,100	12,800	+ 9,700
,, Germany	300	300	—
,, Belgium	275	—	− 275
Ditto on Govt. account* ...	150	3,200	+ 3,050
Electric wires and cables, uninsulated—			
Total	3,400	1,500	− 1,900
From Great Britain ...	2,400	1,300	− 1,100
,, Belgium	800	30	− 770
,, Germany	100	100	—
Electrical goods and apparatus, n.e.s.—			
Total	19,000	25,000	+ 6,000
From Great Britain ...	12,000	21,000	+ 9,000
,, Germany	1,600	1,500	− 100
,, United States ...	1,800	2,000	+ 200
,, Belgium	3,600	300	− 3,300
Ditto on Govt. account* ...	9,700*	3,900	− 5,800
Electrical machinery and parts—			
Total	22,000	36,000	+14,000
From Great Britain ...	13,000	25,600	+12,600
,, Belgium	800	—	− 800
,, Sweden	3,000	900	− 2,100
,, United States ...	5,000	7,800	+ 2,800
Ditto on Govt. account ...	2,000	2,100	+ 100

* Mainly from Great Britain.

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Lead Mining under Helvellyn.

The reconstruction and extension of the equipment of one of the first metalliferous mines to use electricity underground.

ONE of the few remaining lead mines which are still worked in this country is that of the Greenside Mining Company, near the village of Glenridding, in Westmorland. This mine has been worked continuously for over a hundred years, and is believed to have been the first metalliferous mine to adopt the use of electricity underground. In the opinion of the owners the use of electricity has been an important contributory cause of the mine's success throughout the many vicissitudes which the industry has suffered and which have caused many mines to close down. The electrical equipment of the Greenside mine has recently been re-organised and extended, and it now constitutes an excellent example of up-to-date methods applied to very old workings.

As early as 1891 a complete system of electrical operation was adopted, with a hydro-electric power plant consisting of a 100-h.p. vortex turbine and a belt-driven 100-kW, 500-volt, d.c. generator. The energy was transmitted to the underground workings and used for hoisting, haulage, and for driving air compressors and for pumping. Reliability of the pumping equipment has always been of the utmost importance, as the lower levels of the mine are 2,160 ft. from the outcrop, and 180 ft. below the surface of Ullswater, near the south-west end of which the mine is situated.

Fig. 1 is a general view of the mine. The ridge behind it is a northern spur of Helvellyn. To the right of the mine head is seen the stream which is used for power generation. In 1898 the d.c. generating plant was increased by the addition of a single-jet Gilkes Pelton wheel of 100 h.p., directly coupled to a 100-kW generator, but in 1911 the system was changed to a.c. operation, the two d.c. generating sets being replaced by a 250-h.p. double-runner twin-jet Gilkes Pelton wheel directly coupled to a 200-kW, 2,200-volt, 3-phase, 50-cycle "Metro-Vick" alternator. Fig. 3 shows this plant, which is still at work in the old No. 1 power station. It was supplemented in 1924 by a shaft governor-controlled "Turgo" impulse wheel, directly connected to a 110-kW alternator. The satisfactory performance of this unit led the management to adopt the same type of wheel and governor for its latest power station, which has been completed in the last few months. The new hydraulic plant has therefore been supplied by Messrs. Gilbert Gilkes and Gordon, Ltd. At the same time the electric plant has been completely reorganised and considerably extended, the work being carried out by the Metropolitan-Vickers Electrical Company, Ltd.

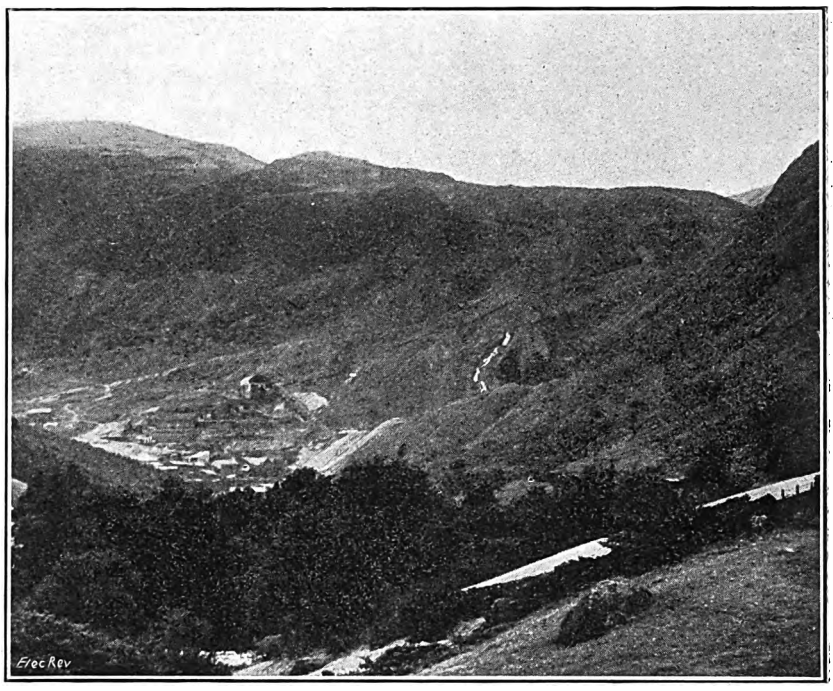

Fig. 1.—The Greenside Lead Mine under a Spur of Helvellyn.

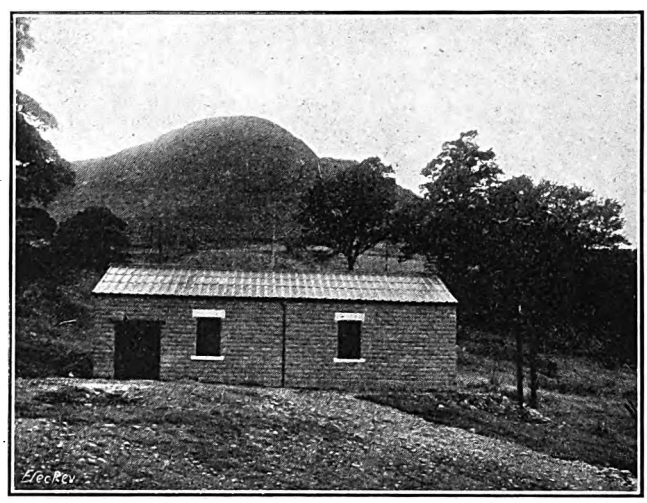

Fig. 2.—New Power House, showing Pipe Line.

The tail water of the old Pelton plant, and the water used for ore dressing and other purposes, is now collected by a small dam and diverted into a headrace canal, 4,500 ft. long, to the forebay of the new station. A pipeline of 21-in. bore, 1,530 ft. long, conducts the water to the power house, fig. 2, where it supplies two "Turgo" impulse wheels, directly connected to alternators of 110 kW and 250 kW capacity, respectively. The smaller of these machines is the "Turgo" wheel referred to above, moved from its old site to the present station. The larger was ordered last year, and erected some months ago. Fig. 4 shows the interior of the new power house with the two sets in service.

The technical data of the two units are of considerable interest to hydro-electric engineers, and are given in the table on p. 1159.

The most striking point is the high specific speed of the later set, resulting in marked economies, both on the hydraulic and electrical sides.

The speed control of the "Turgo" units presents another interesting feature of this installation. A powerful centrifugal pendulum is mounted on the water-wheel shaft, and its sleeve is directly connected to a deflector by links and levers without any servometer or relay. The deflector is interposed between the jet and the runner at reduced loads, and there is only allowed to act on the runner that portion of the jet which is necessary to carry the load. Thus if the load on the generator is light, practically all the jet is deflected; whereas if full load is

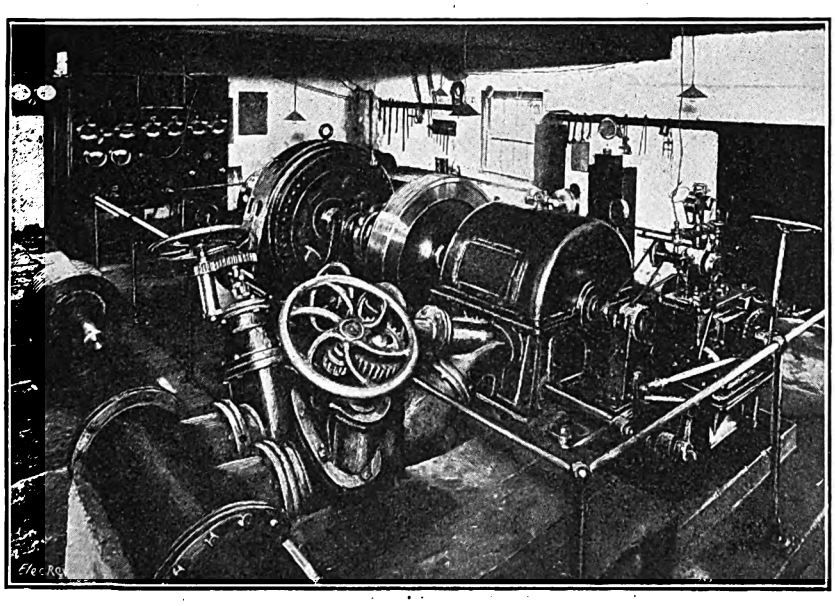

Fig. 3.—A Pelton Wheel Alternator Set in the Old Power House.

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provided by the rotors of the alternators beyond what is necessary for their ordinary electrical and mechanical design. The buckets of the "Turgo" wheel are shrouded at their outer periphery, so that they guide the water more accurately in its passage through the wheel than is the case when unshrouded buckets are used. It is interesting to note that upwards of 150 "Turgo" sets have already been installed and are at work, and it is satisfactory that in a field in which many engineers and others regard the Continent as being pre-eminent, this new design has been developed entirely by a British firm.

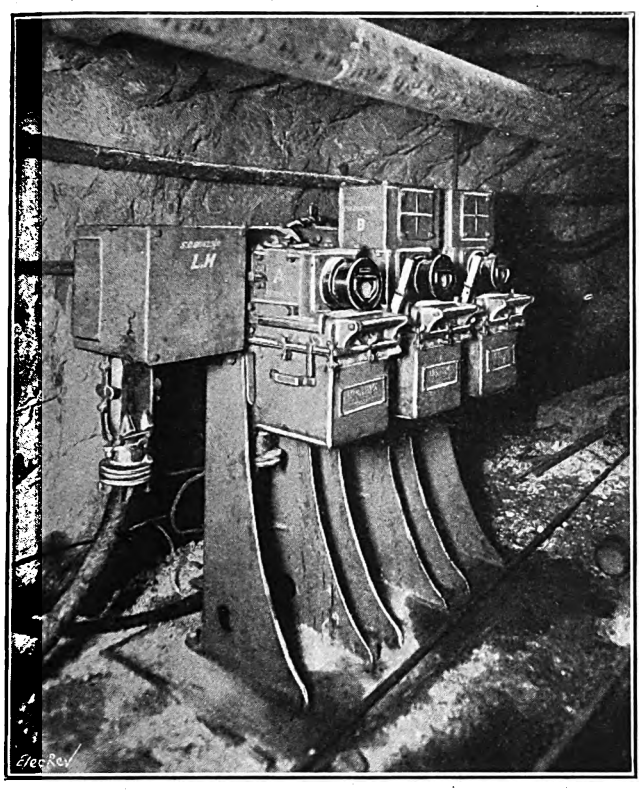

Fig. 7.—H.P. Distribution Board Underground.

Technical Data of "Turgo" Units.

Elec. output of alternator.	B.H.P. of waterwheel.	Speed r.p.m.	Working head in feet.	Date of manufacture
110 kW	170	750	430	1924
250 kW	370	1,000	430	1928

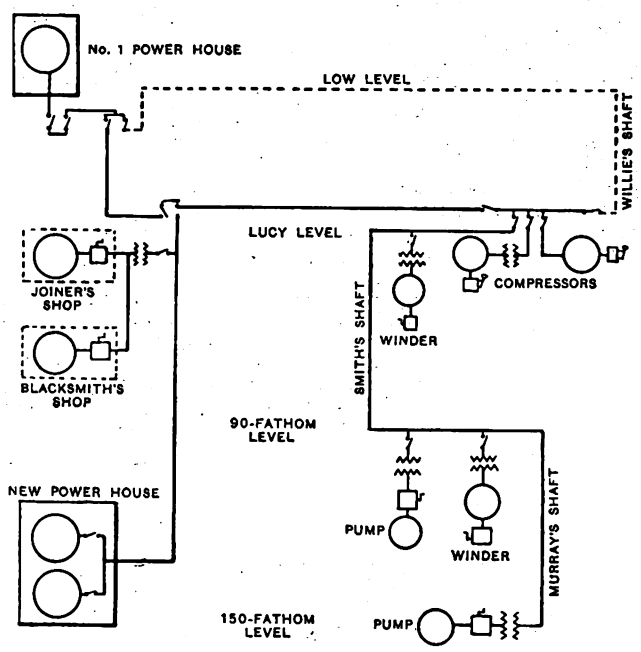

Fig. 8.—Lay-out of Reorganised Electrical System.

Electrical Accidents in Mines.

Extracts from the Report of H.M. Electrical Inspector of Mines for the Year 1928.

THE annual report of H.M. Electrical Inspector of Mines, Mr. J. A. Bernard Horsley, for the year 1928 is now available (H.M. Stationery Office, price 6d. net), and the following is a summary of its principal features. The number of mines at work during the year was 2,539 (322 less than in 1927). Electricity was used in 1,467 of them (61 less than in 1927). The horse-power of motors installed was, nevertheless, increased both above and below ground by 38,209 to 1,722,332, of which 824,672 h.p. was located above and 897,660 h.p. below ground. The h.p. of a.c. motors (all on 3-phase systems and mostly of the squirrel-cage type) represented 80.9 per cent. of the total.

Fatal Accidents Due to Electricity.

There were 15 fatal accidents attributable either directly or indirectly to the use of electricity, involving the loss of 19 lives and injury to 15 other persons. All of these fatal accidents occurred at collieries; three upon the surface works and twelve below ground. Ten of the accidents resulted in ten deaths by electric shock and minor injury to six persons, five in one accident. In another accident, death followed severe burns by the electric arc.

There were four instances of the ignition of firedamp, resulting in the death of eight persons and injury to nine others.

In three of the accidents from electric shock experienced electricians lost their lives while carrying out work in connection with main switchboards at high voltage; the work would not have involved any danger if suitable preliminary precautions had been taken. Preliminary earthing is a legal requirement, and this was pointed out in Mines Department Circular No. 23 published in 1927. In that circular a method was suggested, whereby the circuit could be earthed without risk to the operatoor. This suggestion, however, appears to have received little attention, except from manufacturers of switchgear.

The following cases have been selected from the report:—

Plymouth Colliery, Derby.—An electrician had found a loose outgoing cable connection in a 3-way link disconnecting box and this he proceeded to tighten, with a pair of pliers, after withdrawing the links for the incoming cable. The system was 3-phase at 520 volts with the neutral point earthed, so that the single-phase "shock" pressure was approximately 300 volts. Where such disconnecting boxes are used, the organisation should be directed to ensuring that they are not opened while the pressure is on.

Cambois Colliery, Northumberland.—A timberer was getting up floor to make height on a longwall face, cut by an electrically driven coal-cutting machine, when he struck the live trailing cable with his pick, making contact with one conductor, and received a shock that proved fatal. The system was 3-phase at 600 volts the neutral point being earthed, so that the single phase "shock" pressure was approximately 350 volts.

Motherwell Colliery, Lanark.—A conveyor man while at work with others moving a shaker conveyor forward on a machine-cut face, was killed by electric shock from a wire rope that he was pulling which became charged electrically, because some broken strands had pierced the sheathing of a trailing cable, thus making contact with one of the live conductors therein. The surplus cable had been coiled down on top of the wire rope, and when the frayed end of the rope reached the cable one or more of the sharp broken strands entered the cable, with the result that the cable and many of the conveyor pans became live. Five men besides deceased received severe shocks. The electrical system was 3-phase at 440 volts and the neutral point was earthed. The trailing cable was of the usual type and appeared to be in good working condition. This is another of the accidents due to conveyor shifting while coal cutting is in progress. It would be possible to reduce the risk by using a trailing cable of the type described generically by the term "ferflex," in which there is an earthed metal screen, or light armour, surrounding the live conductors, but a more direct remedy lies to hand in prohibiting simultaneous pan shifting and coal cutting.

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Dewshill Colliery, Lanark.—A hole-borer, while preparing to use a small portable electric drill, received a shock, either from the metal-work of a small transformer or from an exposed end of some temporary connections thereto, which proved fatal. The drill motor was designed for 125 volts 3-phase current, which was furnished by a small transformer reducing from 500 volts. The transformer tank carried a 500-volt 3-pole fuse-switch, with a gland for an incoming armoured cable, and there was also an earthing terminal on the transformer.

Deceased, in the absence of an electrician, proceeded to remake a temporary connection to the plug, and it may have connected the earthing wire to one of the three live contact tubes in the plug. The effect would have been, the transformer tank being more or less insulated, to make the tank and the switch case mounted thereon "live," so that if deceased touched either of these parts, after switching on at the gate-end, he would receive a serious shock. It is possible, of course, that he touched the bare ends of the temporary wires. Apart from the lack of effective supervision the manner of making the temporary connection was unworkmanlike. A trailing cable could have been connected directly to the transformer switch with a plug at the other end to connect to the gate-end switch.

Bargoed Steam Coal Colliery, Monmouth.—An assistant electrician while cleaning and adjusting parts of a truck type switch panel, one of a number forming a main switchboard, appears to have slipped backwards into the cubicle from which it had been withdrawn and so to have come into contact accidentally with live parts which must have caused instant death. The system was 3-phase at 3,300 volts, and deceased appears to have made contact with more than one phase

A mechanical interlock to prevent withdrawal of the truck unless the isolating switches, or the floor below were open, was defective. The isolators were operated by rods and bevel and chain gearing, but this gear was also defective.

There was an order that work should not be begun upon the switchgear unless the corresponding isolator was open, but evidently no effective supervision. General Regulation 131 (*g*) requires that conductors before they are handled, and also adjacent conductors if there is any danger therefrom, as there was in this case, shall be discharged by earthing them.

This Regulation is specific and the need for structural alterations must be faced where such are necessary to enable the operatives to comply with this statutory requirement.

Grimthorpe Colliery, Yorkshire.—An assistant electrician, while cleaning insulators in a transformer chamber above ground, came into contact with, or induced a discharge from, the live terminals of an unrelated circuit housed in the same chamber and died from the effects of burns the next day.

The system was 3-phase at 23,000 volts, with the neutral point earthed.

The electrical apparatus involved comprised a modern switchboard of the cubicle type and in the rear thereof three chambers, each housing one large single-phase transformer, reducing the pressure from 23,000 to 3,300 volts for local use. Bare copper rod passing through the back wall connected the transformer terminals to the corresponding switchgear. One of the transformer chambers was also used to house the cable end, and the bare rod connections therefrom, of a circuit which supplied an electric winder at an adjacent pit. There were, therefore, two separate switches and sets of isolators which it would have been necessary to operate before the transformer chambers could be entered in safety. When deceased entered the third chamber and got upon the top of the transformer he was within easy reach of the bare rod connections to the winder cable, which were alive, and in some way an arcing discharge was brought about between one of the live rods and one of the isolated rods over a distance of approximately 20 in. There was evidence that the discharge had passed over one of the transformer insulators to the metal case. There was, apparently, a single-phase fault to earth and no circuit-breakers were tripped automatically. For the purpose of discharging the bare conductors a length of iron pipe was provided. There was no constructional provision in the switchgear to enable the transformer circuits or the winder circuit to be earthed as a preliminary to work upon them, and it was left to the discretion of the workmen to take any necessary precautions.

Backworth Maude Colliery, Northumberland.—A pan shifter was moving a shaker conveyor at the coal face while the coal-cutting machine was flitting along the face. They were actually sliding a section of the conveyor pan, which was upside down, diagonally across the live trailing cable when the right-angled sharp edges of the pan cut through the rubber sheath and insulation of the cable and made electrical contact with the live conductors.

Deceased fell upon the pan and succumbed, although he appeared to breathe heavily for a short time after 10 minutes and again 40 minutes later.

The electrical system was 3-phase at 650 volts, with the neutral point earthed.

Accidents of this type could be avoided either by arranging for effective supervision or, failing that, by prohibiting conveyor shifting while the coal cutting machine is at work.

Dewshill Colliery, Lanark.—A brusher had been assisting to clear coal from the face remaining over from the previous shift. An electrically-driven gate-end loader had been used. After the coal was all removed a Sylvester was attached to the loader to pull it back out of the way for brushing. There was an unarmoured flexible cable lying on the ground which carried the current to the loader, and when the machine had been withdrawn about 14 ft. one of the wheels passed over this cable, which had not been switched off, cutting into a live conductor, with the result that the Sylvester and the rails became live, the place being very wet. The electrical system was 3-phase at 550 volts, the neutral point being earthed. The earthing system appeared to be in order, but no fuses were blown.

Fauldhead Colliery, Dumfries.—A miner, while pushing a steel tub, ran over an unarmoured flexible cable that had been suspended across the track on nails driven into the head of a prop on each side of the track, with the result that the sheath and insulation were split and the tub or the rails, or both, became "live."

The cable was very insecurely held over the track and it had not been fastened in any way to the nails

The electrical system was 3-phase at 500 volts, and the neutral point was not earthed.

Glencraig Colliery, Fife.—An explosion occurred on starting a motor on a longwall face, which was cut by an electrically driven chain type coal-cutting machine. Seven men were burned, two of whom succumbed.

There was no difficulty in accounting for the ignition of firedamp, for the enclosure of the electrical parts of the coal-cutting machine was seriously defective. The motor was worked by direct current at 500 volts, on the concentric system, the components material to the issue being the plug, the starting switch, and the commutator. The plug and socket coupling of cylindrical pattern was not intrinsically defective, but it was indifferently attached to a bracket on the machine frame and was connected to the starting switch by a short length of cab tire sheath flexible cable, which passed through an unbushed hole in the ½-inch wall of the switch box, leaving an annular gap ranging from a minimum of 5/16 in., with the cable central, to a maximum of ⅝ in. with the cable touching one side of the hole. The original design included a bush for this opening. The door of the switch box consisted of a ⅜-inch steel plate secured by 23 countersunk screws against a sheet of asbestos composition about ⅛ in. thick, which was broken away at a number of places, leaving openings into the switch box. Moreover, several of the screws were loose or ill-fitting. Similar defects in the fixing screws, and also the omission of screws, were observed in other cover plates enclosing, for example, the commutator and the bearing chamber, which was in communication with both the switch box and the commutator. The most extraordinary opening, however, was one that was not contemplated as a possible hazard by the designer. Owing to incorrect lacing of the haulage chain, two slots had been cut by the friction of the chain into the cheeks of the end frame of the machine. One of these opened a way into the switch box. Instead of passing the chain round the idler pulley it had been laced directly from the leading pulley to the driving pulley so that it bore hard upon the projecting parts of the frame. This machine had been subjected to an elaborate mechanical overhaul. The condition in which the enclosure of electrical parts had been left, after this overhaul, is only explicable upon the assumption that those responsible did not realise that the machine was to be used where firedamp might accumulate in dangerous quantity.

Auchengeich Colliery, Lanark.—An explosion occurred in a dummy road opening on to a point near the middle of a 200-yard longwall face worked with electrically driven coal-cutting machines and belt conveyors, whereby one man was killed outright, suffering fracture of the skull, and two others were injured.

The trailing cable for the machine was carried along the face and down the dummy road, about 40 ft., to a gate-end switch and fuse box.

It was found that a fall of roof and side had taken place near the brushing at the end of the dummy road upon the trailing cable, which had drawn the plug out of the switch box.

Although the machine men aver that the machine was not cutting at the time of the explosion, no other cause could be found than electricity, and it is assumed that a spark or arc at the plug, when it was withdrawn from the socket while carrying load current, ignited an accumulation of firedamp in the dummy road. The circuit was 3-phase at 500 volts.

There were two mechanical interlocks between the plug and the switch box. One consisted of a vertical spring-borne pin engaging with a recess in the face of the plug when depressed by closing the lid of the fuse box compartment. This interlock was effective, provided the plug was inserted fully. When examined *in situ* it was not found possible to insert the plug sufficiently far to engage the interlock.

The other interlock, a horizontal spring-borne rod, was designed to prevent the switch from being turned on except when the plug was fully inserted into the socket. This interlock was inoperative owing to a rusted bearing, so that the defect here contributed to the failure to observe or remedy the defect in the other interlock. There was also an interlock between switch and cover of this box which was broken.

The armoured roadway cable was brought into this gate-end box through an open gland, i.e., there was no bushing and the cable dividing box was not sealed with insulating compound, so that there was a ready opening for the entry of firedamp and for the passage of flame. In consequence of this explosion compressed air was substituted for electricity in this section.

(To be concluded.)

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The Heat Pump.

A suggested Economical Method of Producing Low-grade Heat from Electricity.

By T. G. N. HALDANE, M.A., A.M.I.E.E.

(*Extracts from a paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

EVEN in the most efficient power stations wherein the conversion of the heat energy of coal into electrical energy is effected under the best possible conditions, the highest thermal efficiencies at present attained do not exceed about 25 per cent., and in consequence the cost per British thermal unit of electrical energy produced from fuel is generally high, compared with those of coal and, in most cases, of gas. For many purposes this high cost does not prevent the direct use of electricity as a heating agent, but when heat has to be supplied at ordinary temperatures and in large quantities, and extreme exactitude of regulation or ease of operation is not essential, it is much more difficult to justify its use. To a large extent this difficulty has been met by the cheap supply of electricity during off-peak periods at the bare operating cost, but unless coal can be obtained at a much cheaper price by the power station than by the consumer, *e.g.*, when low-grade coal can be used by the power station but not by the consumer, the economic difficulties are apt to be considerable. When coal is consumed in hot-water boilers the percentage generally does not exceed the 25 per cent. applying to electrical energy. In the case of gas the overall efficiency of heat supplied is about 50 to 65 per cent.

Because of these facts many people are of the opinion that electrical energy can never be used economically for producing large quantities of heat under ordinary conditions. That opinion is, of course, based on the assumption that the consumption of 1 kWh can at the best produce about 3,400 B.th.u. It may therefore surprise many electrical engineers to learn that this assumption is by no means justified. It is, in fact, possible to produce a very much larger number of B.th.u. by the consumption of this amount of electrical energy, provided it is converted first into mechanical energy and then used on the Carnot principle to pump heat from a low to a higher temperature. If we imagine a perfect reversible heat engine operating by taking heat from a source at a high temperature T_1 and rejecting it at a lower temperature T_2, so producing mechanical energy, the efficiency, *i.e.*, the ratio of the mechanical work produced to the mechanical equivalent of the heat taken in, is $(T_1-T_2)/T_1$. Carnot showed that this is the greatest possible efficiency of any type of heat engine working between these temperature limits. If we imagine the Carnot engine reversed (supplied with mechanical energy and made to pump heat from a low to a higher temperature) the heating efficiency* is $T_1/(T_1-T_2)$; therefore if (T_1-T_2) be small, compared with T_1, a small amount of mechanical work supplied will allow a very much larger amount of heat to be pumped from the one source to the other. In practice the source of the low-temperature heat T_2 would normally be the unlimited heat of the surroundings.

If heat is delivered at 100 deg. F. (560 deg. abs.) and taken in from the atmosphere at 40 deg. F. (500 deg. abs.) the efficiency is 9.33, *i.e.*, 560/(560−500). That is to say, for every B.th.u. of electrical energy put into the heat pump, 9.33 B.th.u. will be delivered at a temperature of 100 deg. F., and as each B.th.u. of electrical energy may have required the consumption of some 5 B.th.u. at the power station, the remarkable fact is revealed that it is at least theoretically possible for the consumer of the electrical energy produced at the generating station to obtain very considerably more heat than was required to produce the electrical energy which he consumes. In other words, there is economy in fuel consumption, as compared with direct conversion, if the fuel is first consumed in a power station, converted into electrical energy, and then used to produce heat by means of a heat pump. In the above example the economy is (9.33−5)/9.33=46.5 per cent., but it only exists if the heat required is comparatively low-grade, *i.e.*, low-temperature heat. The economy becomes greater as the temperature range is decreased, and reaches a very high value indeed when the range of temperature through which the heat is to be pumped is only a few degrees. The general principle of the above process was first pointed out by Lord Kelvin in 1852, and a description will be found in his "Collected Papers," Vol. 1, p. 515.

The reversible heat engine has so far been treated simply as a heat pump, the most familiar type of which is the refrigerator; its primary object is the production of cold rather than heat, but the two operations are complementary. The process of producing cold is simply that of pumping heat from a relatively cold to a relatively hot source, particular attention being paid to the prevention of leakage of heat into the cold source, whereas no attempt is made to prevent the escape of heat from the hot source. If treated as a heat pump in which the primary product is the heat rejected to the hot source, the order of importance would be reversed and every opportunity would be given for the leakage of heat into the cold source and every precaution taken to prevent leakage of heat from the hot source. Apart from this and minor differences in the temperature ranges over which the plant would work, a refrigerator is precisely the type of heat pump which, for the purposes of this paper, it is desired to consider.

The author shows both from theoretical considerations and from practical tests on refrigerating plant that, when heat at a comparatively low temperature is required, heating efficiencies of the order of from 300 to 500 per cent. or even more may be obtained.

The application of this principle to the heating of buildings and for such purposes as the heating of public baths is discussed, and estimated figures for a public-bath installation are given. The paper concludes with a description of experiments the author has been carrying out dring the past two years, which have demonstrated the soundness of the general principles on which the heat pump is based.

The system can be applied most favourably for central heating when (*a*) the heating system in the building is designed to operate at a comparatively low temperature, *e.g.*, panel heating; (*b*) plenty of water is available for the evaporator, *e.g.*, near a river or canal; an alternative to (*b*) would be the use of an air-heated evaporator, but its size and cost would, in general, be considerably greater.

An alternative method would be to supply heat directly to air blown into the building through a series of ducts. The air would be heated by passing over the hot condenser coils and the exhaust air would be sucked out by a fan and passed over the evaporator coils, where it would give up its heat before being passed out of the building. With this system it would probably be possible to work at lower temperatures than those assumed for the panel-heating hot-water system, with a corresponding gain in heating efficiency. Cross connections would enable the system to be reversed and the building cooled in hot weather, which could be effected more easily with the air-duct system suggested. Although in this country the periods during which it might be desirable to cool a building are comparatively short, there is no doubt that the possibility of such cooling would be a valuable asset. Any refrigeration which might be required if, for instance, the building were a large hotel could be supplied very simply. When comparing the heat pump with other methods allowance should be made for the possibility of combining the production of ice on a commercial scale, which would admit of very profitable use being made of the plant during the summer, when the more usual forms of heating apparatus are lying idle. In this way a large proportion of the capital charges of the installation might be paid.

The modern panel-heating system is peculiarly adapted for applying the heat pump to the central heating of buildings because it can be operated at a considerably lower temperature than that of the ordinary radiator system; it can, in fact, be operated with water supplied at temperatures between 110 and 120 deg. F., or possibly, with an increased amount of panel piping at temperatures even lower than this. It would not be difficult to avoid running the plant during the worst hour of peak load, so obtaining power at a comparatively low cost. With a heat pump the cost per 3,400 B.th.u. would be considerably less than the cost of a unit of electricity taken during off-peak hours. If, for instance, the cost of electricity taken during off-peak hours for a thermal-storage system were 0.25d. per unit and the corresponding cost of the heat-pump plant 0.5d. per unit, the cost of 3,412 B.th.u. supplied by the heat pump would be between 0.167d. and 0.125d., a reduction of from 30 to 50 per cent.

An ideal application is to the heating of swimming baths, normally at a temperature of between 70 and 80 deg. F.; not only would an extremely high heating efficiency be obtained, but also an ordinary type of refrigerating plant could be used with practically no modifications. In the case of one of the large London public baths, when allowance is made for the installation of 150 kW of stand-by immersion heaters and

* The term "heating efficiency," as applied to the heat pump, denotes the ratio, measured in hundreds per cent. of the heat produced to the heat equivalent of the electrical energy supplied. Although this is not the true efficiency from a thermodynamic point of view, it is the efficiency from the standpoint of this paper, *i.e.*, the production of heat by the consumption of electrical energy.

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the waste water from the slipper baths is passed through the heat-pump evaporator, thus saving the bulk of the heat in that water, which would otherwise be lost, comparative figures are as follows:—

	Coal-fired	Electric
Total capital cost	£1,900 ...	£2,700
Total annual charge ...	1,822 ...	1,290

The net annual saving (after allowing for capital charges) amounts to £532 per annum, or approximately 30 per cent. of the total annual cost of a coal-fired system.

As part of the experiments which the author has made, a small heat pump was installed in his home in Scotland and was used for domestic purposes. The compressor employed is a small ammonia machine manufactured for ordinary refrigerating purposes and electric power (unfortunately somewhat limited in amount) is obtained from a hydro-electric installation, which also supplies the cooking and lighting requirements of the house and power and lighting on two neighbouring farms. During the winter the plant has been used both to supply domestic hot water and for central heating; during the summer it has been run only at night to supply hot water for domestic purposes, and also to make ice. The latter is formed in the evaporator tank, on the surface of the coils immersed therein.

One of the main objects in installing this experimental plant was to obtain information about the general convenience of operation of such apparatus, and in many respects the information obtained on these points has been of more interest than the data relating to operating efficiency. Generally speaking, the author's experience is that the plant is extremely simple to operate and requires very little attention. Compared with any coal-fired central-heating apparatus, the heat pump has the very great advantage that it can be started in a few seconds, and can be shut down by the operation of an ordinary electric light switch. The adjustment of the expansion valve was the only operation involving some care, which has been obviated by means of an automatic valve which keeps the pressure in the evaporator constant at any required value.

In conclusion, the author does not suggest that the heat pump is always the most economical method of heating buildings. The object of the paper is to draw attention to its possibilities in order that, when conditions are favourable, this method of utilising electrical energy for heating may be used. It is probable that the heating of swimming baths is the most suitable field for the immediate application of the system.

The author acknowledges his indebtedness to Mr. L. Chew, of Messrs. L. Sterne and Co., without whose co-operation the experimental work could not have been carried out.

Electricity Supply in Russia.

Power station construction progress and an indication of the tota capacity available in the Soviet Union of Republics.*

IN the absence of precise details it is not easy to form an exact idea of the progress which is being made in the electricity supply industry in Soviet Russia. However, in a recent issue of "E.T.Z." (Berlin), Herr G. Dettmar, who lately spent five months in the country at the invitation of the Soviet Government, during which time he claims to have had opportunities of visiting the majority of the large power stations in the country, gives some information about the present position.

The author points out that, owing to the various commissions through whose hands they have to pass, considerable time elapses between the drawing up of plans for power stations and their actual construction and completion. First, there is the Glavelectro, the higher division of electricity, which is responsible for the drawing up of plans and their subsequent execution. All projects have next to be submitted to the Z.E.S., or central electrical committee, and then to the Gosplan, the commission which is concerned with the study of the general plan of Soviet Russian developments. Finally, all schemes are submitted to the Council of National Defence, the final decision being taken by the W.S.N.Ch., or the superior economic council.

Electricity supply stations are divided into three classes: (1) plant which is of interest to the whole Soviet Union; (2) stations which affect one or other of the various Republics of the Union; and (3) communal power stations. Of the first class there are twelve installations in operation, and ten in course of construction, while plans for a further twelve stations are included in the next five-year programme. Among the difficulties that have to be dealt with are the great distance the power has to be transmitted, the low density of population, and the fact that in many cases houses, &c., have to be built to form a village, or small town, near the site of the projected station. The geographical distribution of fuel supplies is, moreover, not very convenient. Perhaps the greatest difficulty in the carrying through of projected plant is the lack of the necessary capital. Hitherto, the Soviet Government authorities have refused to grant concessions to private undertakings for the construction and working of power stations, but, owing to the lack of financial resources, it has recently modified its policy to the extent that concessions may be granted in respect of eleven of the projected national installations.

From a total of 328,000 kW in 1913, the total capacity of the electricity generating stations in Russia increased to 702,000 kW in 1926, while at the beginning of October, 1928, there were eighteen large stations with a capacity of 522,000 kW and 642 small sets of plant totalling 320,000 kW in operation in the country. Petroleum is used as fuel in the majority of the power stations (34 per cent.), peat following with 24 per cent., coal 23 per cent., 13 per cent hydo-electric, and 6 per cent of a mixed character. Special attention is being devoted to the utilisation of peat for steam-raising purposes.

Herr Dettmar next deals with the electricity supply position in the various industrial districts. In the Moscow area there are four separate distribution systems, which will be retained until the completion of 30-, 50-, and 115-kV transmission lines which are in progress, and a projected 220-kV line. The city of Moscow, which has two million inhabitants, is supplied by the Union of Electrical Works, an undertaking comprising five stations with a total capacity of 255,000 kW, which is to be increased to 500,000 kW in 1931-32. A 300,000-kW station, to provide additional supplies for Moscow, is also to be erected near Bobriki, nearly 140 miles away.

In the Volga industrial area there are several new stations, including those at Nijni Novgorod, Jaroslaw, and Ivano-Wosnesensk. The Leningrad district is at present supplied by six stations, of which two are new, two old ones have recently been modernised, and two are eventually to be superseded. The total capacity is at present 167,000 kW, but is to be increased to 260,000 kW during 1931-32.

In the Ukraine district, which includes the Don coal-mining area, there are 35 power stations with a capacity of 228,000 kW, which is to be increased to 300,000 kW by 1931-32. In Caucasia, which is well situated as regards petroleum and gas supplies, as well as water power, two large generating stations are in operation, six in course of construction, and five are projected.

In the Ural area, which is rich in minerals of all kinds, two large power stations, one using coal and one peat, are at work and one in process of erection. In Siberia and Central Asia, while large sources of water power are available, the relatively small population is not favourable to its early development. The construction of four generating stations is, however, contemplated.

In addition to those mentioned above, there are over 600 small power stations in the country, as well as about 900 small sets of plants in agricultural districts, where the cost of generation is somewhat high.

The Soviet Government authorities are now devoting considerable attention to the rational and economical use of fuel. Only those industrial establishments which cannot take their supplies from the State-operated stations are allowed to establish their own plant, subject to the condition that the fuel is rationally used. Counting only plant of over 500 kW, authority has been given to 125, with a total capacity of about 700,000 kW. More than half of those stations are producing, or will produce when completed, not only electric power, but will also supply steam for heating and hot water for public use.

It is interesting to note the increasing use of high-pressure steam in Soviet Russia. There are 37 installations working at pressures of from 495 to 568 lb. per sq. in., and one, the Tege soap factory, is operating at 850 lb. per sq. in.

Finally, it may be mentioned that, according to the present plans, the electric power production capacity of Russia will, by 1933, amount to 2,650,000 kW.

* See also ELEC. REV., December 13th, 1929, pp. 1031 and 1040.

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Naval Radio-telegraphy.

An Account of the Development of Apparatus for Naval Communication at Sea.

By G. SHEARING, B.Sc. M.I.E.E., and Capt. J. W. S. DORLING, R.N., M.I.E.E.

(*Extracts from a paper read before the* WIRELESS SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

WHILST spark and arc systems were mainly employed by ships at sea during the 1914-18 European war, to-day, except for special emergency purposes, spark transmitters are becoming obsolete and arc transmitters have been almost entirely replaced by valve transmitters in all types of ships, and now single valves are in use at sea which are capable of dissipating 8-10 kW at their anodes under oscillatory conditions. The high-power sets developed up to 1923 were long-wave transmitters for long-range working, but during this year long-range experiments at sea at frequencies above 3,000 kilocycles per second (100 m.) were commenced. Regular service routines employing short waves between England and naval ships and shore stations overseas have been in operation since 1926.

Apart from the direct application of wireless telegraphy to communication, the apparatus developed by H.M. Signal School at Portsmouth for distant control by the use of wireless signals of target ships is well known.

The requirements to be filled by a naval wireless telegraph system are that it must link up the ships of far-flung squadrons with their own commander-in-chief and with the Admiralty. The backbone consists of a series of naval shore stations situated in various British possessions throughout the world, in most cases forming a continuous chain of communication. All ships, down to destroyers, also use special low-power sets for fire control. The requirements of a naval wireless system are many and varied, and the overall efficiency of the Navy must depend largely on the efficiency of its wireless communications.

Typical office arrangements, apparatus design, and sea-going requirements are described and illustrated diagrammatically. Power is obtained from the ship's ring main through motor-generators, which are remote automatically-controlled, the auto-starters employed being so designed that they do not "throw off" under the normal vibration of the ship or shock from gun fire. The safety inter-lock circuits embrace the air blowers for valve cooling.

The types of telegraph transmitting circuit used are not discussed. The later designs employ master-oscillator types of generator circuits, the frequencies in certain cases (for the shorter waves) being stabilised by quartz-crystal control. The introduction of short-waves has modified the requirements very considerably. Their advantages for long-range working at distances from a few hundred miles up to world-wide ranges during certain portions of the 24 hours of each day are well known, and it has been necessary to arrange for the fitting of attachments to existing longer-wave sets capable of transmiting on a band of waves covering 4,300 to 21,500 kilocycles per second (70 to 14 m.).

The control stages are designed for operation on either long or short waves, and the main stage for short-wave operation comprises a high-frequency double-acting system of two valves which are neutrodyned to avoid retroaction; for long-wave working the valves are used in parallel. Signalling is obtained by grid-potential control. Switching arrangements are provided whereby the change from long-wave to short-wave working can be effected.

For shore station short-wave transmitters used for point-to-point working, quartz-crystal controlled transmitters are employed for frequencies of the order of 7,500 to 10,000 kilocycles per sec. (40 to 30 m.). In certain cases, frequency-doubler circuits are employed for transmission on the coresponding band of 15,000 to 20,000 kilocycles per sec. (20 to 15 m.), so that one crystal controls transmission on the two waves; the amplifier circuits are of high-frequency double-acting design, the third harmonic of the crystal frequency being selected and amplified. Automatic signalling is provided for by grid-potential control of one of the lower power stages, using a Creed relay. In the case of all naval ship transmitters, the circuit design is such that no spacing wave is transmitted and all ship transmitter have arrangements for listening-through.

The assembly and design of the components are a compromise between electrical and mechanical requirements, as the shock of gun fire causes the decks and bulkheads of the wireless telegraph offices in some ships to whip by as much as ½ in.

The fact that the main wireless telegraph office is usually situated below the main armoured deck has necessitated the fitting of special trunks whereby the high-frequency energy may be delivered to the main aerial with minimum loss and without danger to personnel. The trunk itself is of steel, in some cases copper-lined; recently a porcelain bowl-shaped insulator has been used with suitable fittings for securing it to the lower deck casting. The upper casting and the central cylindrical conductor are at the aerial high-frequency potential, the lining being an anti-brushing shield of spun copper fitted through the hole in the deck. The aerial feeder inside the trunk is a copper tube of about 2 in. diameter. The insulator itself is not of sufficient strength to withstand considerable pressure in an upright direction, and for this reason the steel trunk itself is designed to be a watertight structure. Two types of aerials have been employed, either: (i) sausage aerials having two or more legs, each comprising 10 wires on circular spreaders at about 1 ft. diameter, or (ii) flat roof aerials of about 6 or 8 single wires in parallel, arranged along yards of 30 to 40 ft. in length. There is very little difference in the communication, and the chief advantages of the flat roof over the circular-spreader type are the reduction of strain on the masts for a given aerial sag and windage, the greater ease of handling, and the reduction in cost. The run of the aerial feeders is of very great importance for efficient working. They must be set well clear of all obstructions and, especially, kept as far as possible from the tops of the funnels to avoid (*a*) reduction of effective height, and (*b*) the losses which otherwise may occur due to the low resistance from ionisation of the gases. On submarines provision has to be made for raising and lowering the main aerial, which is only employed for surface working, so that the mast is usually telescopic; for instantaneous working immediately after surfacing a smaller (fixed) aerial is employed.

The main receiving apparatus for heavy ships is installed in a "silent" room, which forms a portion of the main wireless telegraph office. It has been laid down as a general policy that all receiving instruments shall be operated independently of the ship's mains, and the power supplies for the anodes and filaments are for this reason taken from accumulators. The newer models employ dull-emitter valves with filament batteries of 4 volts; the anode batteries are usually limited to 50 volts owing to weight and space considerations, the receiving bays being supplied from a common anode battery *via* a cushioning unit to prevent interference. Experimental investigations are at present in hand with rectified alternating current and with d.c. generators as sources of supply (with or without a floating battery). Anode voltage for receivers does not appear to present any insuperable difficulties, but good regulation in a central receiving room when the filament current may be changed suddenly from 5 amperes to a few milli-amperes renders the problem much more difficult.

The wiring and arrangements of the receivers to reduce interference of many kinds has to be very carefully carried out; running machines are especially troublesome, and in this connection the importance of good workmanship in commutators and slip-rings in order to reduce sparking and ripple voltages cannot be over-emphasised.

Reception is over a band of from 12.5 to 6,000 kc/s (24,000 to 50 m.) and the requirement that the majority of naval receivers must be non-radiating necessitates an increase of circuit complications and in many cases increases the number of valves required for a given amplfication.

More recently the general policy of the design of receiving gear has been modified, the unit construction being departed from to a considerable extent. The later designs of amplifiers now include note-magnification and separate heterodyne in one unit, and in the case of reception on waves of the order of 600 m. and above special provision is made for multiple reception on one aerial. To cover the short-wave requirements two types of special tuner-amplifiers have been developed: a simple oscillating detector with two stages of note magnification, and an oscillatory detector preceded by a stage of high-frequency amplification to prevent oscillations from the detector reaching the aerial and being radiated; also, receivers have been developed employing a detector valve operating on the threshhold of oscillation in conjunction with a separate quenching valve. For automatic reception at shore stations, a special circuit has been developed using the double heterodyne principle. In ships, the fact that reception in general has to be carried out *via* cables or aerial trunks introduces difficulties due to the fact that for certain waves these may tune as transmission lines. The effects of this may usually be greatly reduced by the use of very loose aerial coupling, although loss of signal strength is thereby occasioned, especially in the case of interrupted-continuous-wave signals.

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The apparatus has to be used in all climates, and, whilst every effort is made to reduce size and weight, instruments designed for use in H.M. ships are generally of more substantial construction than is considered necessary for shore work. A number of parts, components, and units which lend themselves to assembly in various ways for various purposes have been developed with a consequent saving in cost and in the time required for production. When the quantities required are large, mouldings, die castings, and stampings are stocked by the Admiralty and issued to contractors as required. In addition, commercially produced components which are standarised in the trade and suitable for the required purpose are used whenever possible.

Direction-finding has great tactical importance. The type of system fitted largely depends on the structure of the ship. As a general rule it is the practice to fit the Bellini-Tosi system, consisting of two loops in planes at right angles. Sometimes, however, where no suitable loops can be rigged, a rotating frame coil is fitted.

The responsibility for the experimental development and adaption of apparatus for naval communications rests with the Captain, H.M. Signal School, Portsmouth, where a staff of naval signal and civilian officers work side by side. The naval officers are attached to the Signal School for short periods only, usually two years, and in this way there is a continuous flow of officers from ships at sea who have intimate and up-to-date knowledge of performance at sea.

The director of the Signal Department, Admiralty, is in the closest touch in all signal matters with the Captain, H.M. Signal School, and is in direct touch with the Board of Admiralty; the reports from the various Commanders-in-Chief at sea are considered by the Director, and the policies to be adopted as a result of the reports are formulated by him after consultation with the Captain for the approval of the Board.

The experimental scientific staff of the Signal School is pooled under the Director of Scientific Research for the Admiralty, and a close liaison exists between the Signal School and the other Government and industrial organisations.

Following the production and satisfactory tests of first experimental models, first in the Signal School laboratories and then at sea, final designs and specifications for components are prepared and competitive tenders invited. The apparatus delivered by manufacturers is tested for acceptance by the Signal School, and is later installed in ships under the direction of Signal School fitting-out officers. B.E.S.A. standards are always adopted whenever possible, but proprietary articles are not usually embodied in designs for service use unless they are of sufficient outstanding merit to out-balance the disadvantages of dependence on one source of supply.

Alternating-current Potentiometers.

The Theory, Evolution, Accuracy, and Applications of such Instruments for Testing Purposes.

By C. V. DRYSDALE, O.B.E., D.Sc., F.R.S.E., M.I.E.E.

(*Extracts from a paper before the* METER & INSTRUMENT SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

NO department of electrical testing involves such difficulties and such costly equipment as that of accurate a.c. measurements. The great majority of a.c. and p.d. measuring instruments have only a limited range, owing to the square law which underlies their operation, so that to cover the range from, say, a few milliamperes to several thousand amperes, and from a few millivolts to 100 kV, a formidable array of such instruments is required, which is still further increased when polyphase circuits have to be dealt with and wattmeters have to be provided for power and phase measurements. The battery of costly instruments for covering the above requirements within an accuracy of 1/10th of 1 per cent. is beyond the resources of all but Government Departments and wealthy concerns: a single instrument which can deal with the situation, even at some sacrifice of convenience and accuracy, is certainly the greatest need of the instrument maker and smaller standardising laboratories.

The most universal of direct-current testing instruments is the potentiometer, first suggested in practical form by Sir Ambrose Fleming in 1885, and developed by Col. R. E. Crompton, which has persisted with only minor modifications to the present day.

Its great range and accuracy soon led to a desire for a similar instrument for a.c. testing, and various suggestions for transference devices to enable the alternating p.d. to be measured to be balanced against an equal continuous p.d. derived from the potentiometer were made. The "thermo-convertors" recently introduced by Dr. Moll, of Utrecht, would seem to be ideal for this purpose, as, owing to the large number of thermo-junctions employed, a temperature-rise in the heated wire of only a few degrees is amply sufficient, and they can be very accurately paired.

As early as 1891 Herr A. Franke conceived the principle which is now used in all a.c. potentiometers, namely, of balancing the alternating p.d. to be measured by a known alternating p.d., which can be varied both in magnitude and phase so as to reproduce the former exactly. His device consisted of two small alternators with a common revolving field magnet coupled to a driving motor, and has proved of great value in telephone and cable investigations.

Unfortunately the Franke device was little known in this country, and in 1908 the present author independently conceived the principle of considering the alternating p.d. as a vector, and balancing it both in magnitude and in phase by a similar p.d. derived from a potentiometer fed with alternating current from a phase-shifting transformer.

Reference is made to other forms of a.c. instruments that have since been devised. The first commercial potentiometer on the rectangular principle was introduced by Mr. D. C. Gall in 1923, who has recently produced a simplified portable self-contained model for approximate commercial tests. The latest in principle and one of the most simple was that devised by Dr. O. Pedersen in 1919, of the rectangular co-ordinate type. The a.c. potentiometer principle is also applicable to the measurement of h.f. up to radio frequencies, and a valuable start has been made in this direction by Messrs. B. S. & F. D. Smith, at the Admiralty Research Laboratory, with the polar type having a phase-shifting transformer. An ingenious valve a.c. potentiometer on the polar principle for frequencies up to 10,000 cycles per sec. has been devised by Mr. E. C. Wente, of the research laboratories of the American Telephone Co. and Western Electric Co.

The chief constructional features of the three principal types of a.c. potentiometers are dealt with:—The Drysdale-Tinsley instrument constructed by Messrs. H. Tinsley & Co., is divided into six sections: (*a*) the potentiometer, (*b*) the phase-shifting transformer, (*c*) the dynamometer current indicator, (*d*) the change-over switch for conversion from d.c. to a.c. working (*e*) the selector switch, and (*f*) the terminal slab. The potentiometer proper is a standard type of Tinsley universal potentiometer having two dials and a slide wire with transposition circuit, which the author considers to be the best compromise for accurate and rapid working.

The Gall co-ordinate instrument has the two potentiometers only contained in the case, the phase-splitting transformer and dynamometer being external; the potentiometers are of the Crompton single-dial and slide-wire type and the instrument, like the author's form, is constructed by Messrs. H. Tinsley & Co.

The Campbell-Larsen potentiometer has recently been put into commercial instrument form by the Cambridge Instrument Co., the potentiometer and variable mutual-inductance standard being in separate cases; this allows of the latter being detached for other uses.

Of all electrical instruments which have been devised, the a.c. potentiometer is by far the most universal in character, and its applications are so numerous that the author limits himself to a general account of them with detailed instructions and examples of only a few of the most important ones. It must be premised that, in common with other devices of a universal character, there is no pretension that the a.c. potentiometer is superior, or even equally accurate or convenient for any given test, to some of the special instruments, but it does allow of nearly all of these tests being made with ample accuracy for most practical purposes, with very little accessory apparatus. The bulk of the applications are described with reference to the author's polar potentiometer, as it is the only one with which he has had much experience; but the modifications necessary for the rectangular co-ordinate type of instrument will in most cases be obvious. All the ordinary d.c. potentiometer measurements can be made with the instrument.

On account of its universal character the author pays some attention to its first installation, especially as it is not readily portable, and lends itself to measurements on distant circuits. If it is once properly set up in a laboratory with the arrangements for various tests permanently arranged in different parts of the room, it will be found most useful; but it will be comparatively little used if it has to be specially set up for any particular test.

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The paper, although admittedly most incomplete, should stimulate interest in a.c. potentiometers and help to give them their rightful place as the most valuable of all testing instruments, for both engineering and scientific testing. In view of the great need for such an instrument, it is remarkable that a.c. potentiometers have been so little used. Only three appear to be suited for general testing: the author's, the Campbell-Larsen, and the Gall forms. The author maintains the advantage of the polar principle for general purposes, but excellent work can be done by the Campbell and Gall instruments, and they have some advantages for measurements on circuits having either very low or very high power factors.

A review of the various tests described in the paper and consideration of the apparatus which would be required to cover them by the ordinary methods, show the saving of cost and time in equipping and testing to be too overwhelming to need any stress being laid upon it. The mere fact of being able to measure p.d.'s from a few microvolts to thousands of volts, and currents from fractions of a microampere to 40,000 amperes, either d.c. or a.c., from 25 to 2,000 cycles, to an accuracy of about 0.1 per cent. with the potentiometer and a set of volt boxes and mounts is in itself sufficient, without reckoning its application for phase measurements, inductance, capacity testing, &c.

New Electrical Devices, Fittings, and Plant

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

Universal Ball Joints.

A range of ball joints which find a wide application in the construction and operation of all kinds of machinery and apparatus is marketed in this country by Messrs. E. H. JONES (MACHINE TOOLS), LTD., Britannia Wharf, Baldwin Terrace, Islington, N.1. In use the joints are attached to the ends of shafts to take either power- or hand-operated motions through angles, or to allow lateral flexibility between driving and driven units. The single joints are designed to work at angles up to 45 deg., and the double joints up to 90 deg. Among their applications in the electrical and allied industries may be mentioned the connection from a control handle on a switchboard or starter panel to a remote part of the apparatus, the drive from a motor to a machine to take care of any mis-alignment between the two, or to allow the motor to be accommodated in an awkward position, and the synchronous drive from a motor of the projector and reproducer in "talkie" film apparatus. In the equipment of workships the joints also find many diverse applications. Fig. 1 shows the construction of the joints. The ball has four squared faces through which two holes are bored to take the pins of the two sets of links which join each half of the joint. The links are fitted in slots in the bodies A and held by pins, the whole being covered by sleeves B which are a forced fit and extend the length of the bodies. In the larger joints provision is made for constant lubrication from the hollow ball which is filled with oil through a hole in one of the links. The balls and links are hardened in order to leave a soft core to reduce the risk of fracture. The bodies of the joints are bored to standard sizes to take the shaft ends. Fourteen sizes of single joints with bores ranging from ¼ in. to 2 in. and nine sizes of double joints having bores from ⅜ in. to 2 in. are manufactured. Under test the joints have resisted a twisting movement of from 22 ft.-lb. in the smallest size, to 1,500 ft.-lb. in the largest size, without suffering any distortion.

Fig. 1.—Construction of "Werner" Ball Joint.

A Lampholder and Plug Unit.

A novel introduction of Messrs. W. E. BEARDSALL & Co., LTD., 5, Victoria Bridge, Manchester, is the "Xtra-Point" lampholder and plug, for which they are the sole selling agents. The device can be substituted for an ordinary lampholder and will, it is claimed, hang straight. The plug entries are inconspicuously placed in the upper part of the holder. It is made of good quality bakelite and has metal parts of ample carrying capacity. A cord-lock effectively separates the flexibles without compression, and is capable of suspending the weight of an adult. The plug takes the current direct to the heating appliance, and not *via* the lampholder plungers, so that there is no danger of the plunger springs, through overheating, losing their tension, with sticking of plungers and consequent arcing and burn-out. The plug is designed to carry 5 A without over heating, and if subjected to a violent tug it will leave the socket and not bring the pendant with it. The plug reversed will control either the light, the appliance, or both, and in position it does not foul or tilt the shade or holder. The apparatus offers an opportunity to the contractor of supplying a robust article to clients who cannot, or will not, afford wall-plugs in sufficient quantities, with considerably improved future prospects of supplying such essentials as irons, vacuum cleaners, bowl fires, and so on. A Home Office pattern, with a skirt, for use with portable tools in factories will shortly be ready, followed by an Edison-screw pattern. The holder is fully covered by patents both at home and abroad. Fig. 2 depicts the construction of the unit.

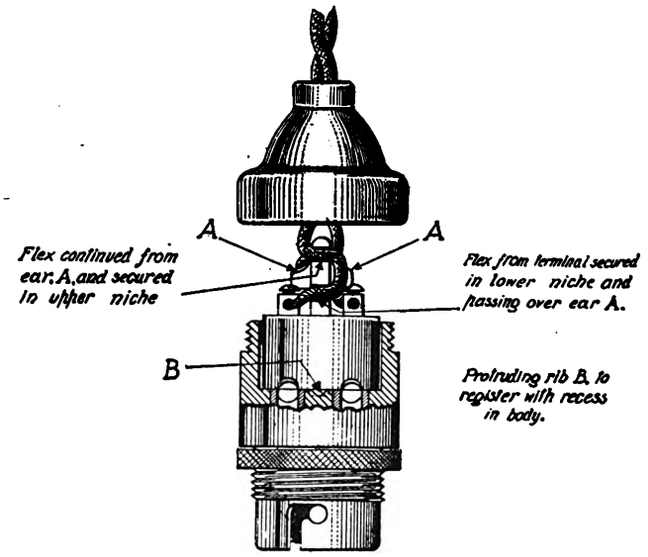

Fig. 2.—Construction of "Xtra-Point" Lampholder.

New Three-Pin "B.S.S." Sockets and Plugs.

Messrs. J. H. TUCKER & Co., LTD., King's Road, Tyseley, Birmingham, have sent us a sample 5-ampere 3-pin plug and socket in a moulded "Telacite" case, as illustrated in fig. 3, complying with British Standard Specification Nos. 73 and 317. A particularly noteworthy feature is that the earth terminal is fitted to an elongated slot *inside* the cover of the socket, instead of on the outside as has been the practice hitherto with 3-pin B.S.S. sockets. The fixing of the earth terminal inside the socket entirely eliminates the possibility of consequential damage, while at the same time the earth terminal may be clearly seen through the elongated slot specially provided for this purpose, so that the socket complies with B.S.S. in respect of rule No. 317 "that the earth wire when in position must be visible." A feature which obviates for ever the troubles due to badly riveted or screwed parts is the provision of socket tubes and terminals in one piece. The spring slotted construction of the socket tubes also ensures a perfect and even contact over the entire surface of the plug pin. We understand that the practice of fixing the earth terminal inside the socket has also been

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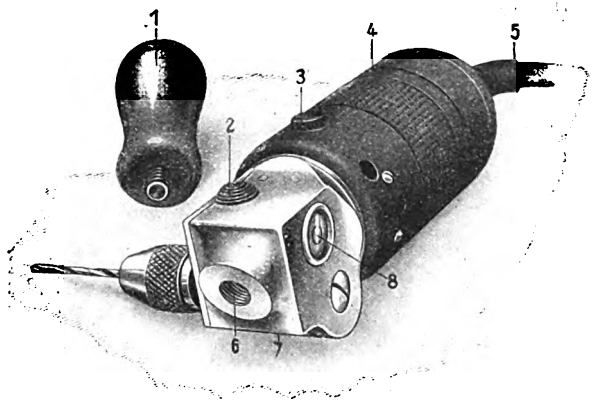
adopted in the 2- and 15-ampere sizes, every one of which in the circular pattern has the B.S.S. rating moulded on the cover. The three-pin plugs provided for use with the sockets are of the hand-shield pattern, and embody a special

Fig. 3.—Three-pin 5-A "Telacite" Socket.

cord-gripping arrangement which will accomodate any size of flexible or c.t.s. cable up to the capacity of the plug without alteration.

A Small Electric Hand Drill.

A recent introduction by the Electrical Equipment and Carbon Co., Ltd., Bank Buildings, 107 to 111, New Oxford Street, W.C.1, is the "Mignon" electric hand drilling machine, fig. 4, which is claimed to be the lightest electric drill yet made. It weighs only 2 lb., including the cables and plug. It is fitted with a universal motor with pendulum bearings, the motor being arranged in a casing made of rubber-free insulating material. The loading is only about 10 watts, so that the machine can be connected to any d.c. or a.c. lighting supply. The drill casing and chuck are also carefully insulated, thus ensuring the utmost safety. The gearbox is of substantial construction, and the drilling spindle runs in ball bearings and is drilled through longitudinally, so as to enable the use of drills of varying length. A precision three-jaw chuck is supplied with the machine of a capacity up to ⅛ in. The drilling spindle is fitted with a



1, handgrip; 2, switch; 3, carbon brushes; 4, insulated motor housing; 5, cable connection; 6, screw socket for handgrips; 7, aluminium drill housing; 8, spirit level.

Fig. 4.—The "Mignon" Hand Drill.

tapered threaded sleeve which can be exchanged for a smaller or larger one, thus permitting the use of different drill chucks up to a capacity of 9/32 in.

The handle can be readily screwed off, a great advantage when drilling in inaccessible places, and for transport.

A High Precision Voltmeter.

The development of a precision voltmeter, which will measure alternating voltage between 20 and 300 volts with an error of only 0.01 per cent., is announced by the United States Bureau of Standards. In any ordinary instrument of the deflecting type a small error is introduced into the readings, because the springs used in the mechanism are not perfectly elastic. In the instrument designed by the Bureau this error has been suppressed, and an optical magnifying system is used which is equivalent to a pointer more than 60 ft. long. Thus, very small deflections are easily read with high precision.—*Telegraph and Telephone Age.*

Swiss Railway Electrification Programme.

The sections of the Swiss Federal Railways to be electrified in Western Switzerland are as follows:—Neuchâtel-Chaux-de-Fonds-Col des Roches, 1930-31; Délémont-Bâle & Délémont-Delle, 1931-1932; Bienne-Sonceboz-La Chaux-de-Fonds, 1932-1933; Berne-Lucerne, 1933-1934; Neuchâtel-Les Verrières, 1934-1935; Sonceboz-Moutier, 1935-1936; in the year last stated the electrification of Giubiasco-Lugano is to be put in hand.

Legal.

Ogilvy v. Dundee Corporation.

In Dundee Sheriff Court on December 12th Sheriff Malcolm heard agents in an action at the instance of Sir Herbert Ogilvy, Bt., Baldovan, against Dundee Corporation regarding a supply of electricity to premises connected with a bleach field on the estate. For the Town Council, the Depute Town Clerk pointed out that the premises were beyond the burgh of Dundee, and so far as the supply of electricity was concerned the Electricity Committee were not the undertakers. The suppliers beyond the burgh boundary were the Grampian Electric Supply Co. For Sir Herbert Ogilvy it was contended that although the premises were outside the burgh boundary the Corporation was bound to supply electricity because of agreements come to in 1907 and in 1914 by which it undertook the supply of electricity at the plaintiff's request. The particular part of the estate in which the bleach field was situated was outside the supply area of Baldovan estate, as specified in the 1914 Act. An agent for Sir Herbert said it was true that the proprietor had asked the Grampian Supply Co. if it was in a position to supply him, and the reply was that it was not able to do so. The agent pleaded that the supply of electricity was a matter of real urgency as a firm had been in occupancy for two months and had had to close down daily at 3 p.m. because of the want of artificial light. His Lordship reserved judgment.

Gibson and Another v. Hull Corporation.

In the Chancery Division on December 19th, Mr. Preston, K.C., applied to Mr. Justice Farwell for an injunction restraining the Hull Corporation from discharging 115 employés of the Tramway Department who were taken on during the general strike of 1926. He explained that the action was being taken by two of the men concerned on behalf of them all.

Mr. Wilfrid Hunt, for the Corporation, said that his clients had already decided not to act upon their resolution to discharge the men until the end of January or February.

Mr. Preston said that he was not prepared to accept a statement made on behalf of the Corporation, but he would accept an undertaking to the effect that notices would not be given to the men before January 17th.

This undertaking was made, and the motion was adjourned until the next sittings

Correspondence.

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession.

The Thawing of Water-pipes.

In your issue of December 20th you publish a few notes concerning the thawing of water-pipes by electricity, and mention that a truly practical method was only available during the first three months of the present year.

It is obvious that you were not aware of the earlier "practical method" of coping with frost conditions which has been available and directly applied for at least seven or eight years now by a German firm of transformer makers. It was they who made the process practical by connecting the terminals of the secondary of a transformer to two solid clamps, which are placed a proper distance apart, direct on to the water pipe, thus producing the necessary amount of warming. In the case of the largest of these house transformers, namely, 200 watts, the secondary current is somewhat in the neighbourhood of 40 amps. at 5 volts, and this has been found to be quite sufficient to deal with the average requirements of small houses.

A. W. Isenthal,
Managing Director,
Isenthal & Co., Ltd.

London, W.3. *December 19th*, 1929.

[We are interested to receive particulars of the German transformer. Our correspondent in Switzerland referred only to conditions prevailing in that country.—Eds. Elec. Rev.]

The All-electric House.

I think your correspondent Mr. W. T. Wardale has, by his letter, earned the gratitude of the electrical profession on the question of the all-electric house. After the cold water douche of your correspondent, Mr. F. J. Moffett, it is a real tonic to read a letter from an electrical man who, first, does believe in his calling, and, secondly, actually puts his belief into practice, which is more important still.

After all, what can we expect of the public if it be found that electrical men themselves are half-hearted in the practice of their profession? It surely is time that electrical men as a whole started to boost their profession as one of the finest propositions on earth, and to tell the public that "the all-electric house" is inevitable on the score of efficiency, convenience, cleanliness, and economy. Mr. Wardale's letter, in my opinion, should be reprinted as a circular letter, posted up in every electrical man's home, and pinned to every electrical contractor's office table as a practical reminder that electricity is a real live proposition to the community at large.

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I sometimes wonder whether the average electrical contractor is yet properly converted to the uses of electricity even in the year 1929, as I have heard one speak of electric heating and cooking with bated breath, and even counsel his staff not to say "too much about it."

No wonder the progress of electricity in this country is shocked when such men damn it with faint praise.

In fact it sometimes appears to me that a society for the conversion of electrical contractors would do a great deal of good in the electrical world.

Whatever may or may not be said about coal, coke, or gas applications to domestic use, it is an indisputable fact that electricity is absolutely pure heat in every way, and cannot be adulterated or chemically played with in any respect. Congratulations to Mr. Wardle for the tonic which should raise the voltage and increase the ampereage of every electrical man in the kingdom.

Hubert W. Haydon,
Managing Director,
RADIA ELECTRIC CO. (GLOUCESTER), LTD.

Gloucester, *December 16th*, 1929.

Standardisation of Sizes of Advertisement Pages.

I am in entire agreement with the letter under the above heading which appeared in your issue of November 29th last. Variations in page sizes are not only expensive, but also extremely inconvenient to the advertiser.

The additional expense involved in having special drawings and blocks made for certain papers is quite a considerable item in proportion to the total cost of buying and filling space in these papers. It seems absurd that one should have to spend possibly £4 to £5 on a revised drawing and new original half-one block to occupy space which itself costs no more than that amount of money. Yet this is a very common experience of advertisers in technical and trade papers.

At present, probably 60 or 70 per cent. of the trade and technical papers can use a block measuring 10 in.×7 in., although in a number of these cases this can only be done by allowing extra white space round the advertisements. Of the remaining 30 per cent. or 40 per cent., perhaps half can use blocks made in the same proportion as 10 in.×7 in., while for the other half, one has to have special drawings made.

Standardisation of page size *must* come sooner or later. Individual papers will, of course, have their individual and peculiar difficulties to surmount in adopting a standard page size. Time, however, will not lessen these difficulties, but will tend rather to accentuate them.

Any objections which may be raised now by a particular paper will be still more cogent in five or ten years' time. Every month and every year of further delay in this vital matter means additional trouble and expense when the change is finally made.

H. E. Goody,
Advertising Dept.,
BRITISH THOMSON-HOUSTON CO., LTD.

London, W.C.2, *December 16th*, 1929.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1928.

15,056. "Apparatus for regulating voltage in alternating-current distribution systems." Ganz-Fele Villamossagi Reszvenytarsasag. May 28th, 1927. (291,101.)

15,905. "System of railway control and signalling." J. Neale. May 31st, 1928. (Cognate applications, 17,662/28, 20,956/28, 31,341/28, and 32,708/28.) (322,197.)

16,009. "Apparatus for regulating voltage in alternating-current distribution systems." Ganz-Fele Villamossagi Reszvenytarsasag. June 1st, 1928. (Addition to 291,101.) (322,199.)

16,178. "Process for the manufacture of glass transparent to ultra-violet rays." Soc. Anon. des Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauny, et Cirey. June 4th, 1927. (291,468.)

16,276. "Process and apparatus for the electrolytic removal of metal from metallic bodies." S. O. Cowper-Coles. June 5th, 1928. (322,118.)

21,116. "Process and apparatus for the separation of visible rays from ultra-violet rays by filtration." J. Y. Johnson (I. G. Farbenindustrie Akt. Ges.). July 20th, 1928. (322,200.)

21,244. "Blocks for switches, ceiling roses, and other electrical fittings." J. J. Brewer and F. F. Brewer. July 23rd, 1928. (322,159.)

21,585. "Electric furnaces." A. E. White (J. J. Naugle). July 26th, 1928. (322,160.)

24,074. "Device for preventing the unauthorised use of electric switches." Pennant Manufacturing Co., Ltd., and A. D. Arter. August 21st, 1928. (322,171.)

24,417. "Electric switches for motor vehicles." M. Charles. September 27th, 1927. (297,769.)

24,488. "Electrical insulating materials." W. S. Smith, H. J. Garnett, J. N. Dean, H. C. Channon, W. Gardner, and H. F. Wilson. August 25th, 1928. (Cognate applications, 29,345/28 and 4,613/29.) (322,208.)

24,613. "Apparatus for the production of sounds and the reception of wireless signals." M. J. Goldberg & Soehne Ges. August 27th, 1927. (Addition to 244,133.) (296,311.)

24,639. "Incandescent electric tubes." H. Hartman. August 26th, 1927. (296,315.)

24,823. "Call-finders for automatic and semi-automatic telephone systems." Standard Telephones and Cables, Ltd., E. P. G. Wright, J. H. E. Baker, and A. H. Cameron. August 29th, 1928. (322,190.)

24,850. "Telephone apparatus for transmitting and/or reproducing audible signals." S. L. Price. August 29th, 1928. (322,192.)

25,111. "Photo-electric cells and circuits therefor." G. M. Wright and S. B. Smith. August 31st, 1928. (322,225.)

25,462. "Automatic or semi-automatic telephone systems." Standard Telephones and Cables, Ltd., and E. P. G. Wright. September 5th, 1928. (322,239.)

25,463. "Power cables." Standard Telephones and Cables, Ltd., and J. K. Webb. September 5th, 1928. (322,240.)

25,464. "Automatic and semi-automatic telephone exchange systems." Standard Telephones and Cables, Ltd., and E. P. G. Wright. September 5th, 1928. (322,241.)

25,463. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., W. H. Paulett, and C. Gillings. September 5th, 1928. (322,242.)

25,519. "Feeder distribution boxes particularly for wireless aerials." J. Brown. September 5th, 1928. (322,244.)

25,646. "Galvanic batteries." L. Fuller and G. J. A. Fuller. September 6th, 1928. (322,251.)

26,499. "Light signals for controlling railway and other traffic." British Power Railway Signal Co., Ltd., and E. C. Irving. September 15th, 1928. (Cognate application, 32,730/28.) (322,262.)

27,188. "Electric cigar or the like lighter." Schoeller & Co. Elektro-Technische Fabrik Ges. September 21st, 1927. (297,442.)

27,931. "Radio valve circuits." Igranic Electric Co., Ltd., and A. D. A. Hodgson. September 28th, 1928. (322,271.)

29,115. "Electrolytic production of protective coatings of peroxide of lead on electrical conductors." Siemens & Halske Akt. Ges. October 22nd, 1927. (299,306.)

29,284. "Transformer coils, particularly for wireless receiving apparatus." Brandes, Ltd., T. D. Ward-Miller, and A. K. Paterson. October 11th, 1928. (322,283.)

29,360. "Electric batteries." E. P. Griffin and W. A. Buckley. October 11th, 1928. (322,285.)

29,700. "Electric power apparatus for dairy farms." General Electric Co., Ltd., and W. P. Gauvain. October 15th, 1928. (322,288.)

29,968. "Electric blasting fuses." J. Schurmann and Fabrik Elektrischer Zunder Ges. October 17th, 1928. (322,290.)

30,866. "Electrical amplifying arrangements." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieke). October 24th, 1928. (322,234.)

31,052. "Electric incandescent lamps or similar articles." Westinghouse Lamp Co. October 31st, 1927. (299,780.)

31,240. "Tramway and other vehicle brakes." Electro-Mechanical Brake Co., Ltd., and L. A. Catlin. October 27th, 1928. (Cognate application, 6,262/29.) (322,298.)

31,535. "Vacuum electric tube devices." Westinghouse Lamp Co. October 27th, 1927. (299,847.)

31,365. "Sound-emitting apparatus." J. Pintsch Akt. Ges. November 2nd, 1927. (299,841.)

31,722. "Sparking plugs of internal-combustion engines." F. L. Brown. November 1st, 1928. (322,301.)

32,961. "Electric contact breakers." British Thomson-Houston Co., Ltd., A. P. Young, and L. Griffiths. November 10th, 1928. (322,308.)

32,962. "Electric contact breakers." British Thomson-Houston Co., Ltd., A. P. Young, and L. Griffiths. November 10th, 1928. (322,309.)

33,006. "Horns and trumpets for talking machines, loud-speakers, and like instruments." J. G. Coombs. February 21st, 1928. (306,475.)

33,459. "Electrical apparatus." General Electric Co., Ltd., and J. P. S. Pillans. November 15th, 1928. (322,316.)

34,915. "Construction of direction and movement indicator for motor road vehicles." S. S. Warshawer and A. Posner. November 27th, 1928. (322,334.)

36,275. "Constant-speed multi-frequency electrical generating apparatus." W. Dornig. December 8th, 1928. (322,347.)

36,954. "Switch mechanisms as used in automatic telephone and like selective systems." Siemens Bros. & Co., Ltd., and D. A. Christian. December 14th, 1928. (322,356.)

36,969. "Electrical frequency changers." British Thomson-Houston Co. Ltd. December 23rd, 1927. (302,904.)

37,472. "Cooling arrangements of enclosed dynamo-electric machines." W. McGee & Son, Ltd., and G. S. Young. December 19th, 1928. (322,363.)

37,831. "Arrangement for exciting synchronous machines." Siemens Schuckertwerke Akt. Ges. December 23rd, 1927. (302,931.)

38,092. "Electric furnaces." F. B. Woolford. December 24th, 1928. (322,367.)

38,344. "Rapidly-producing uniform metal deposits electrolytically." K. Breusing and U. Gottesmann. December 28th, 1928. (322,371.)

1929.

255. "Transmission of pictures." British Thomson-Houston Co., Ltd. January 23rd, 1928. (304,653.)

1,381. "Electric lamps." F. Farrant. January 15th, 1929. (322,382.)

2,010. "Thermally-responsive electric switches." Associated Electrical Industries, Ltd. January 25th, 1928. (304,724.)

2,757. "Electrical measuring instruments." C. D. Sutton and Cambridge Instrument Co., Ltd. January 26th, 1929. (322,386.)

4,426. "Apparatus for the transmission or reception of ultra-short waves." C. Lorenz Akt. Ges. May 12th, 1928. (311,395.)

4,948. "Dynamometer apparatus for testing internal combustion engines." F. W. Highfield and Highfield Electrical Co., Ltd. February 14th, 1929. (322,394.)

5,641. "Radio-communication systems and the like." Marconi's Wireless Telegraph Co., Ltd. February 20th, 1928. (306,460.)

5,920. "Electrically-heated smoothing irons." Soc. Anon. Calor and L. Trouilhet. February 22nd, 1929. (322,403.)

6,841. "Disk-shaped electro-motors." J. Salomon. February 19th, 1929. (322,409.)

12,020. "Illuminating bodies with concave reflector and diffusely radiating incandescent bulb." C. Zeiss. May 10th, 1928. (311,370.)

12,217. "Telegraph concentrators." Associated Telephone and Telegraph Co. April 30th, 1928. (310,800.)

12,723. "Indirect-lighting system for apartment and for other uses." J. T. Dourgnon. April 25th, 1928. (310,420.)

16,428. "Holder for electric incandescent lamps." K. Geyer and F. Ulbrych. May 28th, 1929. (322,423.)

22,763. "Combined motion-picture and sound-reproducing apparatus." W. E. Beatty (Bell Telephone Laboratories, Inc.). July 20th, 1928. (Divided application on 321,148.) (322,233.)

22,764. "Combined motion-picture and sound-reproducing apparatus." W. E. Beatty (Bell Telephone Laboratories, Inc.). July 20th, 1928. (Divided application on 321,148.) (322,234.)

31,496. "Magnetic clutches." A. K. Croad (Sand Spun Patents Corporation). July 27th, 1928. (Divided application on 321,158.) (322,181.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from December 18th:—

Hum-Dinger. No. 503,668. Class 8. Fixed and variable electrical resistances.—Claude Lyon, Ltd., 76, Old Hall Street, Liverpool.

Gramplifier. No. 507,160. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—H. E. Du Prè, 42, King Street, Jersey. (London representatives: B. J. Wildbore & Son, 101, Leadenhall Street, E.C.3.)

His Master's Voice (lettering and design). No. 507,193. Class 8. Television apparatus and parts thereof, &c.—Gramophone Co., Ltd., Hayes, Middlesex.

Chromolox. No. 498,282. Class 13. Electrical immersion heaters, and heating devices in the form of strips and rings, being part of electric heating apparatus.—Geo. Bray & Co., Ltd., Leicester Place, Leeds.

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New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABINGDON.—Housing scheme (50), for the T.C.; borough surveyor.

BECKENHAM.—Municipal buildings (£83,000), for the U.D.C.; surveyor.

BIRKENHEAD.—Elementary school, The Dell, Rock Ferry; R. W. Johnston, architect to the E.C., Town Hall.

BLANDFORD.— R.C. church; Rev. Father O'Byrne, resident priest.

BRENTFORD.—School, Boston Road, for the U.D.C.; E. Willis, Town Hall, Chiswick (returnable deposit of £33s.)

BURTON-ON-TRENT.—Housing scheme (34), Gordon Street, for the T.C.; borough surveyor.

CANTERBURY.—Development of Hales Place estate, with 100 houses, for Mr. Thomas.

CARLTON (NOTTS.).—Church; Rector of Sacred Heart R.C. Church.

COLCHESTER.—Housing scheme (25 acres), Harwich Road; borough engineer. Extensions, biscuit factory, North Station Road; D. J. McPherson, Burton. Extensions to saw mills, Military Road; Groom, Daniels & Co., Ltd.

CREWE.—Additional 45 houses for the T.C.; L. Reeves, borough architect.

DERBY.—Re-erection of confectionery factory, Chequers Lane, electrically equipped, for William Addey & Sons.

DORCHESTER.—Elementary school, Queen's Avenue; Dorset county architect.

DUMFRIES.—Waterworks (£17,000); burgh waterworks engineer.

EDINBURGH.—Houses (84), for the Corporation. Extensions to city chambers; city architect.

FOLKSTONE.—School, for the Catholic managers; Monsignor Coote.

GLOSSOP.—Lodge and office at Poor Law Institution; Board of Guardians..

GOOLE.—School; education officer, County Hall, Wakefield. Municipal offices; surveyor to U.D.C.

GOUROCK.—Conversion of Pavilion picture house into roller skating rink; the manager.

GUISELEY.—Adaptation of engineering works to swimming baths, for the U.D.C. (£6,000).

HAMILTON.—Housing scheme (270), for the T.C.; burgh surveyor. Cinema for Associated British Cinemas; the secretary.

HASTINGS.—Houses (50), Broomgrove estate. Front improvement, with underground parking station, electric lifts, &c. (£110,000); borough engineer. Fire station (£17,000), for the T.C.; borough surveyor.

HEREFORD.—Housing scheme (40), for the T.C.; Bettington and Son, architects, Palace Chambers (returnable deposit of £2 2s.).

HUDDERSFIELD.—Houses (48), Lowerhouses estate, Almondbury; borough architect, 26, Ramsden Street.

IRISH FREE STATE (WEXFORD).—Reconstruction of courthouse and county office, for the Wexford County Council; W. F. Barry, county surveyor (returnable deposit of £5 5s.).

KIDDERMINSTER.—Housing scheme (86), for the T.C.; borough surveyor.

LEAMINGTON.—School; secretary to the E.C.

LEICESTER.—Housing scheme (100); Leicester Housing Voluntary Association.

LEIGH-ON-SEA.—Proposed St. Margaret's Church; vicar.

LITTLEPORT.—Senior school (320 places); Isle of Ely E.C.

LONDON (EAST HAM, E.).—Houses (100), Claremont Road; borough engineer.

(WOODFORD, E.).—Buildings M.W.B. pumping station (£14,229); F. R. Hipperson & Son.

(FINSBURY, N.).—Tenements, Royley Street (£14,000); borough engineer.

(ST. PANCRAS, N.W.).—Blocks of flats adjoining Cumberland Market; Commissioners of Crown Lands.

LONDON (*continued*).

(HENDON, N.W.).—Shops, L.C.C. Watling estate; R. F. Yeo. Baptist church; trustees.

(GREENWICH, S.E.).—Houses (79) at Charlton Park estate, for B.C.; borough engineer, Royal Hill (returnable deposit of £2 2s.).

(DULWICH, S.E.).—Flats (757) in five-storey blocks, Dog Kennel Hill; L.C.C. architect.

(BALHAM, S.W.).—Five blocks of flats, Beeches Road; Swain and Selley.

LOUTH.—Housing scheme (32), for the T.C.; borough surveyor. Boys' school, for the Governors of King Edward VI Grammar School (£18,329); B. Pumfrey, Ltd., Gainsborough.

LOWESTOFT.—Elementary school, Church Road, for the E.C.

MANCHESTER.—Bank premises, King Street, for Midland Bank, Ltd.

MIDLOTHIAN.—Extension of Currie School (£18,000); Master of Works, Midlothian Education Authority, Edinburgh.

MITCHAM.—Houses (360), Mitcham Road estate; Croydon borough engineer.

NANTWICH.—Housing scheme (60), for the U.D.C.; P. H. Paton, surveyor (returnable deposit of £2 2s.).

OTLEY.—Alterations and additions to White Hart Hotel, for Tadcaster Brewery Co., Ltd.; Garside & Pennington, architects, Pontefract.

RAINHAM (ROMFORD).—Church, for the Wesleyan trustees; J. H. Broadbent, architect.

RAWMARSH.—Housing scheme (100), Ryecroft estate, for the U.D.C.; J. A. Tonge, architect, Council Offices, Parkgate, Yorks (returnable deposit of £2).

RIPON.—Slum clearance; city engineer.

ST. HELENS.—Houses (92), for the T.C.; Chappel & Sons, Ltd., builders, Swinton, Manchester.

SALFORD.—Municipal offices; city architect. Extension of works, Greengate, for Greengate & Irwell Rubber Co.

SETTLE.—Sewage disposal works, including engine house, sludge pumps, &c.; F. J. Rodwell, engineer, 37 & 38, Prudential Buildings, Park Row, Leeds (deposit £3 3s.).

SHEFFIELD.—Housing scheme (88), Wybourn estate; W. G. Davies, city architect (deposit £2 2s.).

SHIPLEY.—Extensions to textile shed, Shipley Technical School; education officer, County Hall, Wakefield.

SHOTLEY BRIDGE.—Methodist church and schools; trustees.

SITTINGBOURNE.—Electric lighting installation, Town Hall, for the U.D.C.; clerk.

SOLIHULL.—Restoration of parish church (£20,000); Rev. C. O. R. Wormald, rector.

STALYBRIDGE.—Houses, Darnton Road; Swallow & Taylor.

SURBITON.—Library and fire station, for the U.D.C.; Joseph Hill, architect, Southborough House. R.C. church, Thornhall Road; Rector of St. Raphael's, Kingston-on-Thames.

SWANSEA.—Houses (1,500) and flats (100). School (480 places), Baptist Well (£16,500); borough architect. Branch library, Oystermouth; librarian. Waterworks; Sir Alexander Binney, Son & Deacon.

TRURO.—Extensions, Royal Cornwall Infirmary; Cowell, Drewit & Wheatly, architects, Mansion House,

TYNEMOUTH.—Extensions to canning factory, Brewers Bank, for Shields Ice & Cold Storage Co., Ltd.; A. K. Tasker, architect.

WHITEHAVEN.—Houses (82), for the T.C.; borough surveyor.

WOKING.—Baptist church, Kingfield; Thomas & Jones, architects, Swansea; Norris & Co., Ltd., builders, Sunningdale.

WOLVERHAMPTON.—Employment exchange, for H.M. Office of Works, King Charles Street, London, S.W.

WREXHAM.—Housing scheme (160), with electrical work, for the R.D.C.; J. Herbert Edwards, engineer, Imperial Buildings (returnable deposit of £10).

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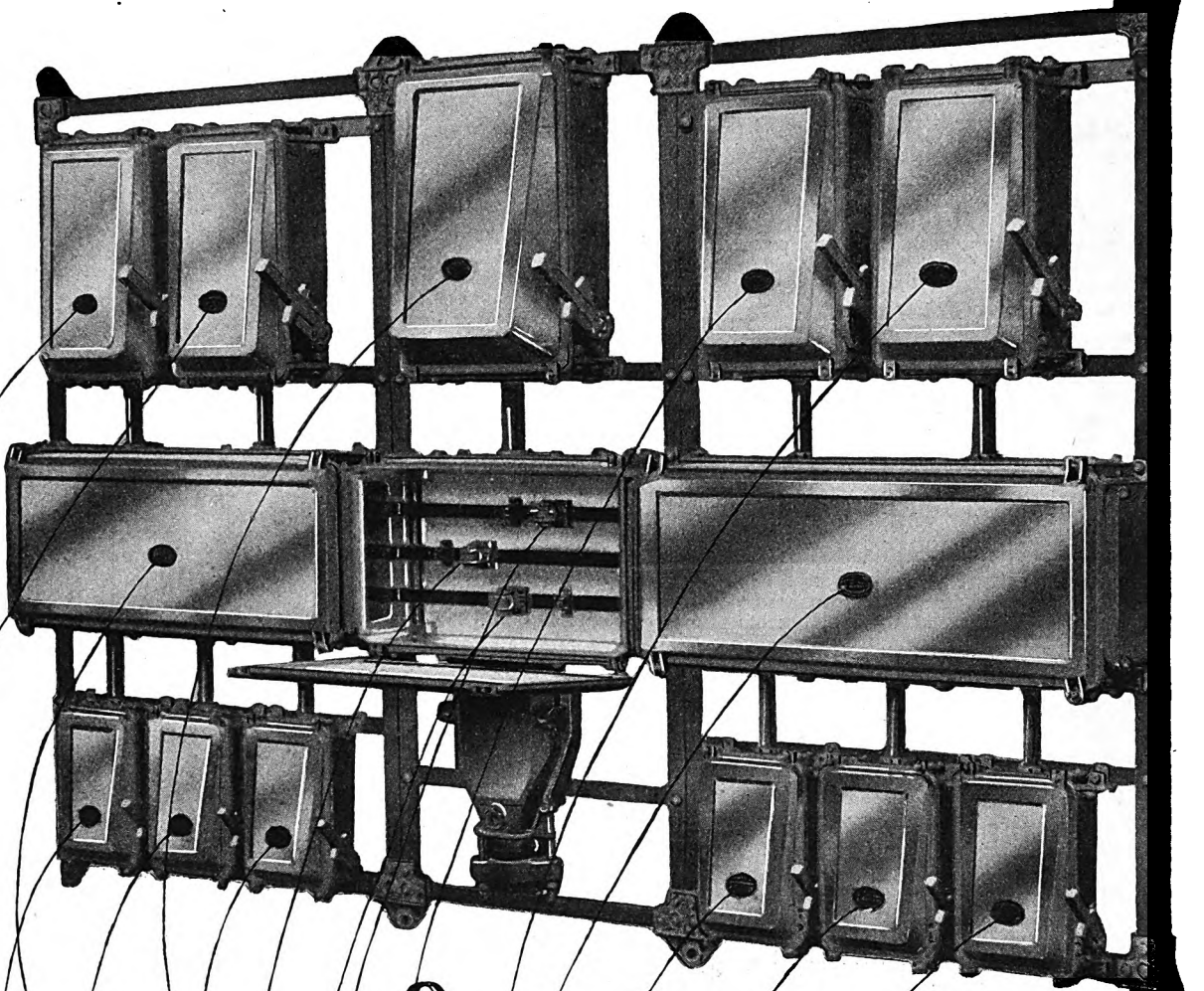
Tenders.



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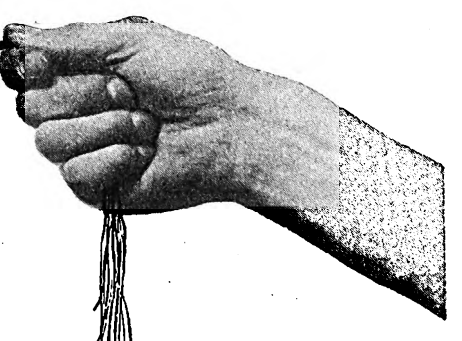

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OFFICIAL NOTICES.

Latest time for receiving, 5 p.m. Tuesday.

STAFFORDSHIRE EDUCATION COMMITTEE.

Installation of Electric Light.

TENDERS are invited from firms whose names appear on the National Register of Electrical Installation Contractors for the installation of electric light in two new public elementary day schools now in course of erection in Brettell Lane, Brierley Hill. A specification and drawings may be obtained by application to Messrs. Moffatt, Rosher & Mann, Consulting Engineers, Union Chambers, Temple Row, Birmingham, with a cheque for a deposit of £5 5s., which will be returned upon the submission of a *bona-fide* tender.

Tenders, endorsed "Lighting Installation, Brierley Hill, Brettell Lane Council Schools, must be delivered by October 31st, 1929, to the undersigned,

F. A. HUGHES,
Director of Education.

County Education Offices, Stafford.
September 24th, 1929. 9999

CITY OF CARDIFF.

Electricity Department.

TENDERS are invited from members of the King's National Roll for the following:—

(1) Supply and erection of a Water-tube Boiler and mechanical Stokers.

(2) Supply and erection of a Fuel Economiser.

Further particulars, specification and form of tender may be obtained from the City Electrical Engineer, Central Offices, The Hayes, Cardiff.

Tenders duly endorsed and addressed to the undersigned must be delivered on or before 10 a.m. on October 21st, 1929.

The Council do not bind themselves to accept the lowest or any tender.

CECIL G. BROWN,
Town Clerk.

City Hall, Cardiff. 9966

(*Continued on Sup. 40*).

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E.D.A. Conferences

LONDON AREA

The following Conferences have been arranged and will take place at the ROYAL SOCIETY OF ARTS, John Street, Adelphi, London, W.C.2. Conferences will commence at 7.30 p.m. o'clock prompt:

Salesmen and others engaged upon electrical work are very cordially invited. Ladies are specially invited to attend and take part in the discussions.

October 18th, 1929.	Title:	PERSONAL SALESMANSHIP IN THE ELECTRICAL INDUSTRY.
	Speaker:	Miss G. Burlton, B.A.
	Chairman:	Sir Andrew R. Duncan, M.A., LL.D.
November 15th, 1929.	Title:	SELLING TIME SWITCHES.
	Speaker:	E. E. Sharp, Esq., A.M.I.E.E.
	Chairman:	Sir John R. Brooke, C.B.
December 20th, 1929.	Display of Electrical Cinematograph Films.	

THE BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION, INC.
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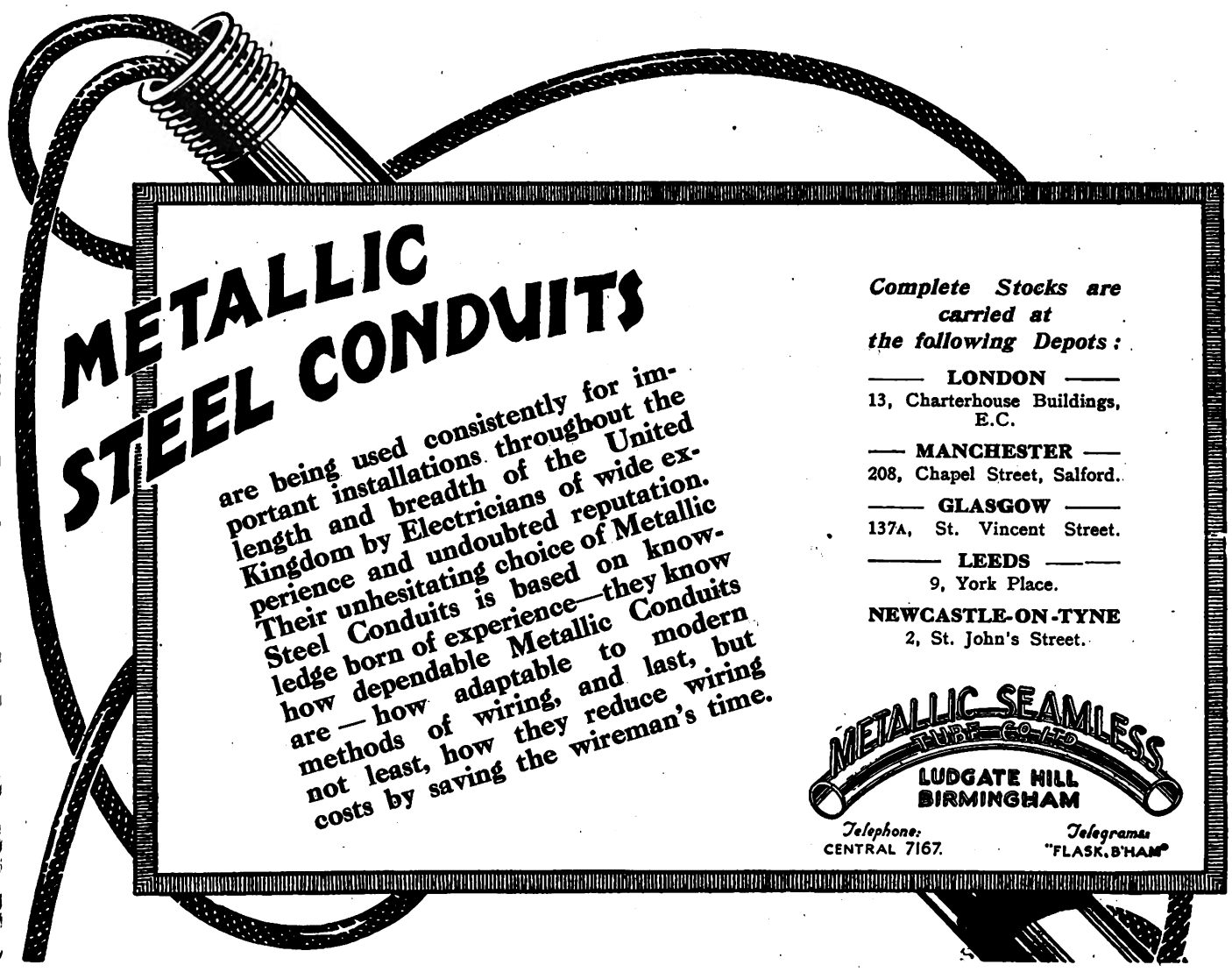

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OFFICIAL NOTICES.—(*Con. from Sup. 38.*)

COUNTY BOROUGH OF HASTINGS.

Electricity Department.

THE Electricity Committee invite tenders for :—

(a) 22,000 volts, 3-phase overhead lines and underground cables, Crowhurst Section No. 6 (approximately 7,000 yards).

(b) 400 volts, 3-phase, 4-wire overhead lines, Aylesbury type, and underground cable, Crowhurst Section, No. 7 (approximately 4,200 yards).

(c) 400 volts, 3-phase, 4-wire overhead lines, Aylesbury type, and underground cable, Whatlington Road, Section No. 8 (approximately 1,000 yards).

Copy of each specification, with Form of Tender, may be obtained from Mr. A. J. Ryan, Borough Electrical Engineer, on deposit of one guinea in respect of each specification (cheques to be made payable to the Hastings Electricity Department). The deposit will be refunded provided a *bona fide* tender has been sent in and not withdrawn. Extra copies may be obtained at five shillings each, which sum will not be refunded.

Sealed Tenders, endorsed with name and address of the firm tendering, and marked "Tender for O.H. Lines, Crowhurst Section, No. 6, Electricity Department," or "Tender L.T. Lines, Crowhurst Section, No. 7, Electricity Department," or "Tender L.T. Lines, Whatlington Road, Section No. 8, Electricity Department," to be lodged in or posted so as to arrive at my office not later than 12 noon on Wednesday, October 23rd, 1929.

The lowest or any Tender will not necessarily be accepted.

An official receipt must be obtained for every Tender delivered by hand. Tenders sent by post must be registered.

D. W. JACKSON,
Town Clerk.

Town Hall, Hastings.
October 1st, 1929. 3001

ST. MARY'S CHURCH, YSCEIFIOG, HOLYWELL.

TENDERS are invited for the installation of Electric Light at the above. These must be delivered not later than October 12th, 1929. The lowest or any Tender need not be accepted.—Particulars on application to Rev. T. Richards, Rectory, Ysceifiog, near Holywell, N. Wales. 3015

CITY OF MANCHESTER.

THE Electricity Committee of the Manchester Corporation invite tenders for the supply, delivery, and erection of :—

Four 33,000-volt, 500,000-kVA rupturing capacity, metal-clad, compound-filled, switch units, &c. (Specification No. 256.)

Two 10,000-kVA, 33,000/6,600-volt, self-cooled, oil-immersed, indoor type transformers. (Specification No. 257.)

Specification and Forms of Tender may be had on application to Mr. H. C. Lamb, Chief Engineer and Manager, Electricity Department, Town Hall, Manchester, on payment of a fee of one guinea for each specification, which amount will be refunded on receipt of a bona-fide tender.

Tenders, duly endorsed and addressed to the Chairman of the Electricity Committee, must be delivered at the Town Hall not later than 10 o'clock a.m. on Wednesday, October 23rd, 1929.

The firms entrusted with the work will be required to enter into a contract to be prepared by the undersigned.

The Corporation do not bind themselves to accept the lowest or any tender.

F. E. WARBRECK HOWELL,
Town Clerk.

Town Hall, Manchester.
September 30th, 1929. 2970

COUNTY BOROUGH OF BELFAST.

Electricity Department.

THE Electricity Committee invite tenders for the supply and delivery of :—

CIRCULATING WATER PIPES.

Specification (No. W.97) with Form of Contract may be obtained from Mr. F. H. Whysall, City Electrical Engineer and General Manager, East Bridge Street, Belfast, on deposit of two guineas. (Cheques to be made payable to the Belfast Corporation Electricity Department.) This deposit will be refunded provided a bona fide tender has been sent in and not withdrawn. Extra copies may be obtained at one guinea each, which sum will not be returnable.

Sealed tenders, endorsed with the name and address of the firm tendering, and marked "Tender for C.W. Pipes, Electricity Department," to be lodged in, or posted so as to arrive at, my office not later than 10 a.m. on Monday, October 21st, 1929.

The lowest or any tender will not necessarily be accepted.

An official receipt must be obtained for every tender delivered by hand. Tenders sent by post should be registered.

R. MEYER,
Town Clerk.

2997

OFFICIAL NOTICES.—*Continued.*

COUNTY BOROUGH OF BRIGHTON.

THE Corporation invite Tenders for the supply of Gasfilled Lamps for Street Lighting Purposes for a period of one year from November 1st, 1929.

Specification, conditions and form of tender can be obtained on application to the Engineer and manager, Electricity Works, North Road, Brighton.

Sealed tenders must reach me before 10 a.m. on October 11th, 1929.

JAS. H. ROTHWELL,
Town Clerk.

Town Hall, Brighton.
October 1st, 1929. 3012

EDUCATIONAL NOTICES.

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YOUR XMAS WINDOWS

See E.D.A. SALES & PUBLICITY CALENDAR for NOVEMBER (E.D.A. 812). Also

See E.D.A. SALES & PUBLICITY PROGRAMME for DECEMBER, 1929 (E.D.A. 818),

which will contain a number of Xmas Windows combining those spectacular features which are necessary to attract attention during the Christmas Season.

The programme will also contain particulars and illustrations of special "properties" for Xmas Windows.

THE BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION, INC.,
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OFFICIAL NOTICES.

Latest time for receiving. 5 p.m. Tuesday.

COUNTY BOROUGH OF STOCKPORT.

Electricity Department.

THE Electricity Committee of the Stockport Corporation invite tenders for the supply, delivery and erection of:—
6,600-volt Switchgear, comprising metal-clad, compound filled, switch units. (Specification No. 3A.)

Specification and forms of tender may be had on application to Mr. Robert Lee, Borough Electrical Engineer, Electricity Offices, 23, Tiviot Dale, Stockport, on payment of a fee of one guinea for each specification, which amount will be refunded on receipt of a bona-fide tender.

Tenders, duly endorsed and addressed to the Chairman of the Electricity Committee, must be delivered at the Town Hall not later than 10 o'clock a.m., on Monday, December 2nd, 1929.

The firms entrusted with the work will be required to enter into a contract to be prepared by the undersigned.

The Corporation do not bind themselves to accept the lowest or any tender.

ROBERT HYDE,
Town Clerk.

Town Hall, Stockport.
November 2nd, 1929. 3330

STONE URBAN DISTRICT COUNCIL.

Electricity Department.

THE above Council invite Tenders for the undermentioned:

Specification 69.2/5. E.h.t., O.H., 11,000-volt Transmission Line (2,300 yds.). Outdoor Sub-stations (2-50 kVA) and l.t. Distribution overhead (1,400 yds.) services, &c.

Copies of the above specification may be obtained (on and after November 8th) from the Consulting Engineer to the Council, W. M. Selvey, Independent Buildings, Sheffield, upon the payment of a deposit of two guineas (cheque). Deposit returnable upon the receipt of a "bona fide" tender.

Additional copies of the above specification may be had on the payment of five shillings (P.O.), not returnable.

Complete tenders are returnable to the undersigned not later than noon, November 25th, 1929.

The Council do not bind themselves to accept the lowest or any tender.

CHARLES H. MATTHEWS.
Clerk.

Town Hall,
Stone, Staffs. 3326

SOUTH INDIAN RAILWAY COMPANY, LIMITED.

THE Directors are prepared to receive tenders for the supply of:—

MADRAS ELECTRIFICATION.

1. Switchgear for stations (Lighting, Power and Signalling).

Specifications and forms of tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W.1.

Tenders addressed to the Chairman and Directors of the South Indian Railway Co., Ltd., marked: "Tender for Switchgear for Stations," with the name of the firm tendering, must be left with the undersigned not later than 12 noon, on Friday, November 22nd, 1929.

The Directors do not bind themselves to accept the lowest or any tender.

A charge, which will not be returned, will be made of 5s. for each copy of specification.

Copies of drawings may be obtained at the Offices of the Company's Consulting Engineers, Messrs. Robert White and Partners, 3, Victoria Street, Westminster, S.W.1.

A. MUIRHEAD,
Managing Director.

91, Petty France,
Westminster, S.W.1.
November 4th, 1929. 3367

BOROUGH OF LANCASTER.

Electricity Department.

MEDIUM TENSION CABLES.

TENDERS are invited for the supply of Medium Tension 4-core Paper-insulated, Lead-covered, Steel Tape Armoured Cables, of British manufacture.

Specification and form of tender may be obtained on application to the undersigned.

Tenders must be delivered to the undersigned at "Electricity," North Road, Lancaster, not later than noon on Saturday, November 16th, 1929.

The Council do not bind themselves to accept the lowest or any tender.

GEO. C. MILNES, M.I.E.E., A.M.I.M.E.,
Borough Electrical Engineer.

"Electricity," North Road, Lancaster.
November 5th, 1929. 3379

OFFICIAL NOTICES.—*Continued.*

COLWYN BAY URBAN DISTRICT COUNCIL.

Electricity Department.

GLAN CONWAY & LLYSFAEN ELECTRICITY SUPPLY.
CONTRACT No. 17.

TENDERS are invited for the supply, erection and laying complete of Extra High Tension and Low Tension Overhead Lines and Cables in connection with the above supply.

Specification, schedules and form of tender can be obtained from the Engineer, Electricity Offices, Colwyn Bay, on deposit of a fee of one guinea, which will be returned on the receipt of a *bona fide* tender.

Tenders, endorsed "Glan Conway Electricity Supply," to be delivered at the offices of the undersigned not later than 12 noon on Saturday, the 16th day of November, 1929.

The Council reserve to themselves the right to reject the lowest or any Tender.

Dated this 5th day of November, 1929.

JAMES AMPHLETT,
Clerk to the Council.

Council Offices, Colwyn Bay. 3378

CITY OF SALFORD.

TENDERS invited for one Electric Travelling and Slewing Jib Crane, suitable for weights or grab to 2½ tons, normal capacity.

Full particulars and specification may be obtained on application to the City Electrical Engineer, Frederick Road, Salford. Offers to be received on or before November 25th, 1929.

3340 H. H. TOMSON, Town Clerk.

EDUCATIONAL NOTICES.

Advertisements are inserted under this heading at 14s. per inch.

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All instruction is by correspondence from text-books specially prepared by many experts for tuition by post.

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HOW TO ASSESS THE VALUE OF ADVERTISING SCHEMES

III

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Salesmen representing firms whose products are advertised in the "Sunday Pictorial" should send for a copy of our circulation distribution map. They will find it most useful in explaining to their customers the degree of support which their firms' advertisements are giving.

Enquiries, which should be made on business letter headings, should be addressed to S. D. Nicholls, Advertisement Manager, "Sunday Pictorial," Geraldine House, Fetter Lane, London, E.C.4. Telephone, Holborn 4321.

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OFFICIAL NOTICES.

Latest time for receiving, 5 p.m. Tuesday.

PARISH OF STEPNEY.

To Radio and Electrical Engineers and Wireless Apparatus Manufacturers.

THE Guardians of the Poor of the Parish of Stepney are prepared to receive tenders for the installation of Wireless Receiving Equipment and Apparatus at each of their three Hospitals, viz.:—

Mile End Hospital, Bancroft Road, Mile End, E.1.
St. George-in-the-East Hospital, Raine Street, Old Gravel Lane, E.1.
St. Peter's (Whitechapel) Hospital, Vallance Road, E.1.

The extent of the work and apparatus required may roughly be gauged from the following particulars:—

	Headphones required.	Loudspeakers required.
Mile End Hospital	368 pairs	11
St. George-in-the-East Hospital ...	339 pairs	3
St. Peter's (Whitechapel) Hospital	452 pairs	10

together with low tension charging machines; high tension generators; motors to drive generators; accumulators; ancillary apparatus; wiring, &c.

Conditions of contract, drawings, specifications and form of tender may be obtained at my office on payment of a deposit of one pound (cheques to be made payable to the "Treasurer of the Stepney Guardians") which will be returned on receipt of a bona-fide tender.

Tenders must be delivered to me in the envelope marked "Wireless apparatus—Guardians' hospitals," and must reach this office by not later than twelve o'clock noon on Thursday, December 5th, 1929.

By order,
S. McCLELLAND,
Clerk to the Guardians.

Administrative Offices,
Bancroft Road, Mile End, E.1.
November 6th, 1929. 3400

SWITCHGEAR, &c.

THE Commissioners of His Majesty's Works, &c., are prepared to receive Tenders before 11 a.m. on Thursday, November 28th, 1929, for H.T. and L.T. Switchgear, Transformer and Cables at H.M. Office of Works, Generating Station, South Kensington, S.W.

Drawings, specification, a copy of the conditions and form of contract and forms for tender may be obtained from the Contracts Branch, H.M. Office of Works, King Charles Street, London, S.W.1, on payment of one guinea. (Cheques payable to the Commissioners, H.M. Office of Works.) The sums so paid will be returned to those persons who send in tenders in conformity with the conditions. 3452

HOLYWOOD URBAN DISTRICT COUNCIL.

Street Lighting Standards.

THE Council invite tenders for the supply of 24 Steel Lighting Standards, complete with suitable bracket ladder arm and ornamental cast-iron base. The standards are for supporting lighting units at a height of 18 ft. above ground level. Quotations, together with drawings and description of the standards, to be forwarded to the undersigned not later than 4 p.m. on November 21st. The lowest or any tender not necessarily accepted.

DAVID BELL,
Town Clerk.

Town Hall,
Holywood, Co. Down. 3443

HOLYWOOD URBAN DISTRICT COUNCIL.

Electricity Department.

TENDERS FOR WATT HOUR METERS.

THE Electricity Committee invite Tenders for the supply of Watt Hour Meters. Specification, with Conditions and Form of Tender, may be obtained on application to the Electrical Engineer and Manager, Sullivan Place, Holywood, Co. Down, on the payment of a deposit of £1 1s., which will be refunded on receipt of *bona fide* Tender.

Sealed Tenders, marked "Meters," on authorised form only, must be delivered to the undersigned on or before 4 o'clock on Monday, 25th inst.

DAVID BELL,
Town Clerk.

Town Hall, Holywood.
November 15th, 1929. 3477

EDUCATIONAL NOTICES.

Advertisements are inserted under this heading at 14s. per inch.

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THE first annual general meeting of Radiovisor Parent, Ltd., was held on November 14th, at the Hotel Victoria, Northumberland Avenue, London, Lieut.-Col. the Hon. A. C. Murray, C.M.G., D.S.O., presiding.

The Chairman, in the course of his speech, said that the company was in a strong financial position, having cash resources amounting to over £113,000. One of the most remarkable technical developments of recent years had been the use of light-sensitive processes for various applications, especially in connection with talking films, and so forth. The advent of the Radiovisor Light Sensitive Bridge had placed the selenium cell in forefront of light-sensitive devices. Having such a selenium bridge, a large field of activity was opened up, and the possible applications were numerous. To mention a few: the automatic switching on and off of street lights; the "Invisible Ray" Burglar Alarm; Marine Smoke Alarm; control of water-level in boilers and of smoke of factory chimneys, &c. The bridge should prove of use in many industries, and manufacturers and others were invited to communicate with the company.

It was not the Board's policy to go in for manufacturing apparatus on a large scale other than the Radiovisor Light Sensitive Bridge, and they were prepared to co-operate with manufacturers and make arrangements with them to take over the manufacture and sale of appropriate applications. In cases where firms or individuals wished to make use of the bridge for some particular purpose or application of their own it was the policy to lend bridges and to assist them in developing their ideas.

The patent rights and trade marks for the world, excepting Great Britain, Northern Ireland, Isle of Man, and the Irish Free State, had been sold to Radiovisor Foreign & Colonial, Ltd., in which the Parent Company held a substantial interest. The foreign company had already made considerable progress, having concluded an agreement with the well-known firm of Siemens & Halske A.G., of Berlin, for the exclusive rights to manufacture and sell throughout Europe. Intensive development work is already being carried out in their laboratories and workshops, which should lead to active business.

In conclusion, the Chairman said that the company was financially strong, and with the foundation already laid and the work that had been and was being carried out, they could look forward with confidence to the future.

The report and accounts were unanimously adopted. 3515

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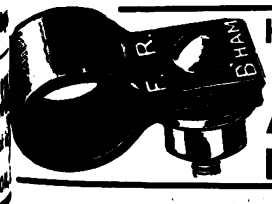

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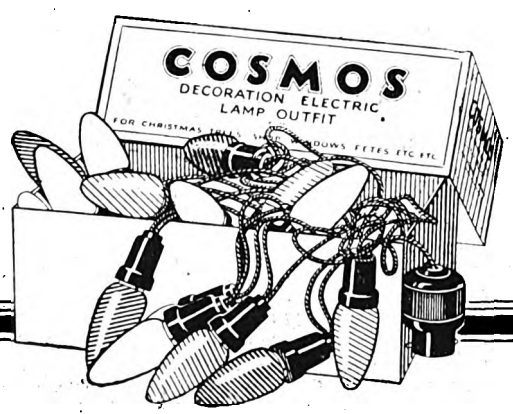

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To Radio and Electrical Engineers and Wireless Apparatus Manufacturers.

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Mile End Hospital, Bancroft Road, Mile End, E.1.
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Tenders must be delivered to me in the envelope marked "Wireless apparatus—Guardians' hospitals," and must reach this office by not later than twelve o'clock noon on Thursday, December 5th, 1929.

By order,
S. McCLELLAND,
Clerk to the Guardians.

Administrative Offices,
Bancroft Road, Mile End, E.1.
November 6th, 1929. 3400

CITY AND COUNTY OF KINGSTON-UPON-HULL.

Electricity Department.

THE Electricity Committee invite tenders for the following contracts, *viz.*:—

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Tenders should be addressed to "The Chairman, Electricity Committee, Town Clerk's Office, Guildhall, Hull," and endorsed "Contract 148," and must be delivered to the above address not later than noon, Thursday, December 19th, 1929.

J. N. WAITE, M.I.E.E., F.I.F.,
City Electrical Engineer.

Electricity Works, Sculcoates Lane, Hull.
November, 1929. 3507

WEST HAM UNION.

THE Guardians invite Tenders for the work of Installing a Fire Alarm System at their Whipps Cross Hospital, Whipps Cross Road, Leytonstone, E.11.

Specification and Form of Tender will be forwarded on application to the undersigned, and Tenders must be delivered not later than 10 a.m. on Thursday, November 28th, 1929.

L. E. FRAQUET,
Clerk to the Guardians.

Board Room, Union Road, Leytonstone, E.11.
November 14th, 1929. 3516

CENTRAL ELECTRICITY BOARD.

Mid-East England Electricity Scheme, 1929.

THE Central Electricity Board invite Tenders for the supply, delivery and erection of 132,000-volt transformers.

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Tenders on the form supplied endorsed "Tender for Specification No. M.E.E.—P.T.1" must be delivered to the offices of the Board not later than 12 o'clock noon on Saturday, December 21st, 1929. The Board do not bind themselves to accept the lowest or any Tender.

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Specification and form of tender may be had on application to Mr. H. C. Lamb, Chief Engineer and Manager, Electricity Department, Town Hall, Manchester.

Tenders, duly endorsed and addressed to the Chairman of the Electricity Committee, must be delivered at the Town Hall not later than 10 o'clock a.m. on Friday, December 13th, 1929.

The firm entrusted with the work will be required to enter into a contract to be prepared by the undersigned.

The Corporation do not bind themselves to accept the lowest or any tender.

F. E. WARBRECK HOWELL,
Town Clerk.

Town Hall, Manchester.
November 23rd, 1929. 3582

CENTRAL ELECTRICITY BOARD.

North-West England and North Wales Electricity Scheme, 1928.

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Copies of the specification, No. N.W.E.-P.L.2 and form of tender may be obtained from the offices of the Board on application to the undersigned on or after Monday, December 2nd, 1929, on payment of a deposit of two guineas for the first copy and one guinea for each subsequent copy.

Sums paid for any number of copies up to three will be refunded on receipt of a bona fide tender.

Tenders on the form supplied endorsed "Tender for Specification No. N.W.E.-P.L.2" must be delivered to the offices of the Board not later than 12 o'clock noon on Monday, January 6th, 1930. The Board do not bind themselves to accept the lowest or any tender.

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THE Guardians of the above-named Union are prepared to receive tenders for 18 electric sterilisers, inside size approximately 12 in. by 6 in. by 5 in., with hinged lid, inside tray, fitted with automatic cut-out, and finished chromium plating. Loading of steriliser 1 kW, to be wired to suit supply from the Battersea Borough Council. A sample and/or a full drawing and specification of article offered to be submitted.

Further particulars can be obtained from the Engineer, St. James' Hospital, Ouseley Road, Balham, S.W.12.

Tenders must be sent in envelope endorsed "Tender for Sterilisers," to Mr. J. F. Harlow, Clerk to the Guardians, Union Offices, St. John's Hill, S.W.18, by 9 a.m. on Wednesday, December 11th, 1929. 3587

CITY OF MANCHESTER.

THE Electricity Committee of the Manchester Corporation invite tenders for the following:—

(*a*) Specification No. B 71.—Delivery and placing into position at the Barton Power Station of TWELVE SINGLE-PHASE FEEDER REACTORS.

(*b*) Specification No. 259.—Supply and erection, within the Manchester area of supply, of ONE 6,600-VOLT SHEET STEEL TYPE TRANSFORMER KIOSK AND SWITCHGEAR.

(*c*) Specification No. 260.—Supply and placing into position, within the Manchester area of supply, of 125-, 250-, 500-, 750-, 1,000-kVA, 6,400/400-VOLT, THREE-PHASE, OIL-IMMERSED, SELF-COOLED TRANSFORMERS.

Specifications, &c., may be had on application to Mr. H. C. Lamb, Chief Engineer and Manager, Electricity Department, Town Hall, Manchester, on payment of a fee of one guinea for each specification, which amount will be refunded on receipt of a bona-fide tender.

Tenders, duly endorsed and addressed to the Chairman of the Electricity Committee, must be delivered at the Town Hall, as under:—

(*a*) and (*c*) 10 o'clock a.m., Tuesday, December 10th, 1929.
(*b*) 10 o'clock a.m., Tuesday, December 17th, 1929.

The firms entrusted with the work will be required to enter into a contract to be prepared by the undersigned.

The Corporation do not bind themselves to accept the lowest or any tenders.

F. E. WARBRECK HOWELL,
Town Clerk.

Town Hall, Manchester.
November 25th, 1929. 3604

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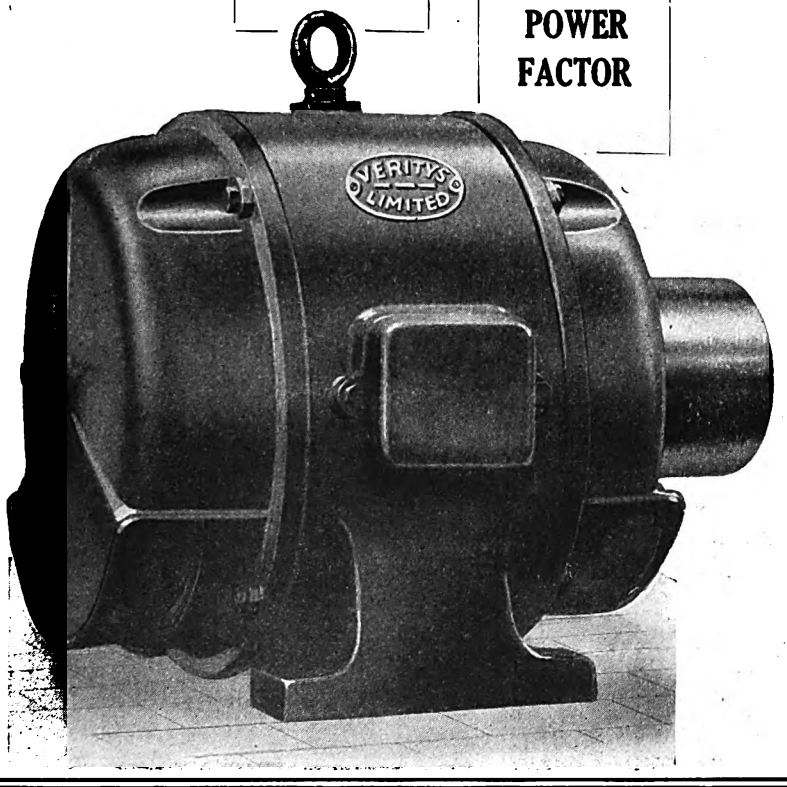

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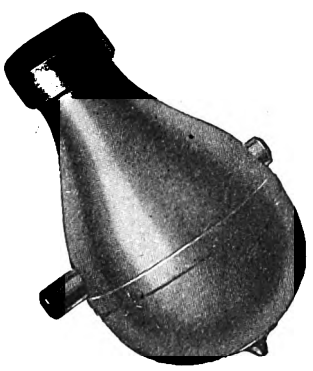

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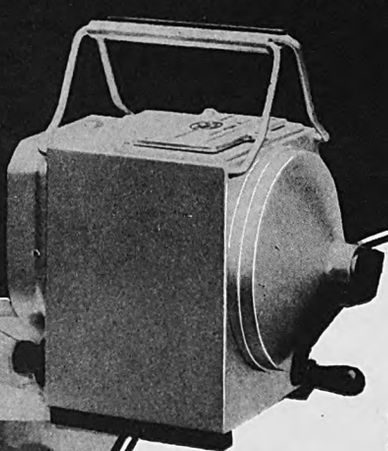

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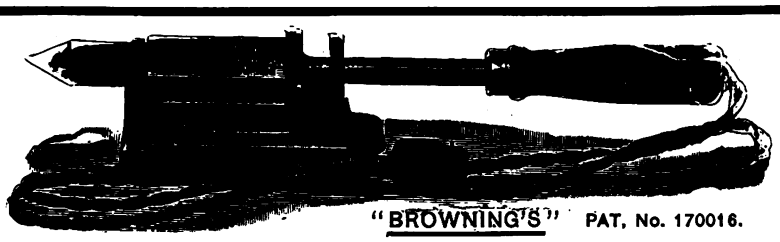

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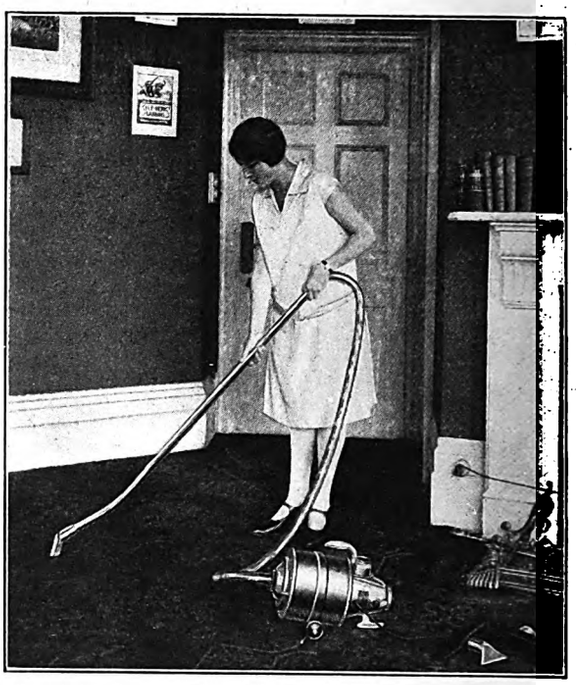

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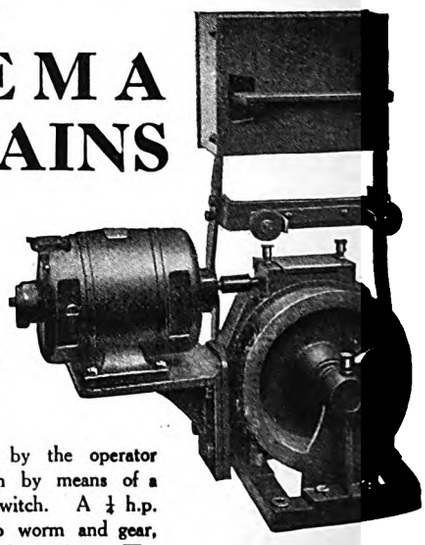

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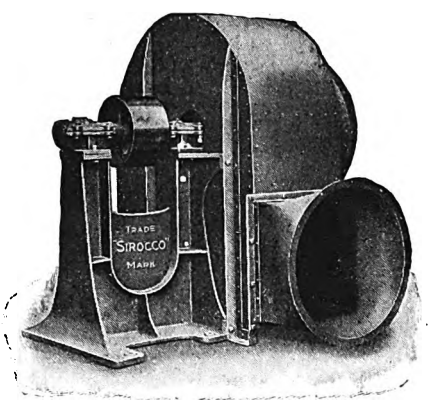

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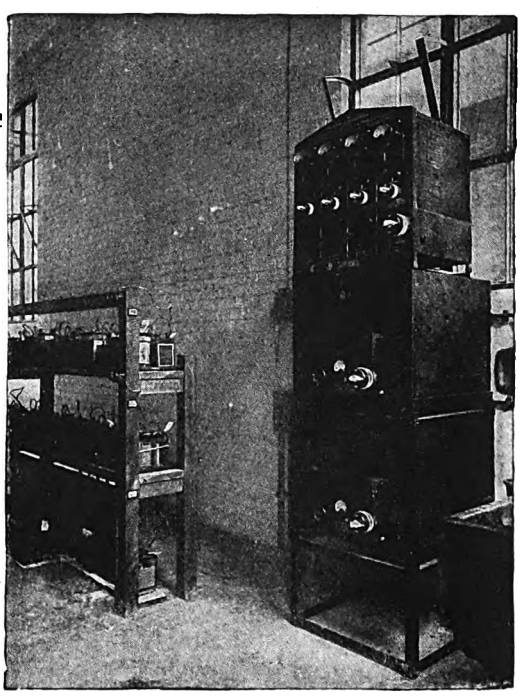

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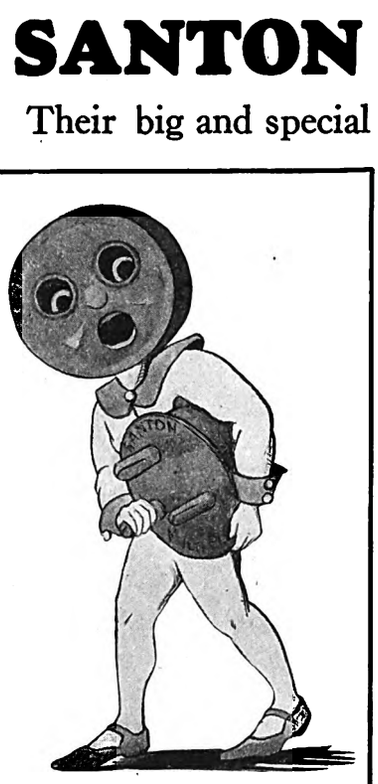

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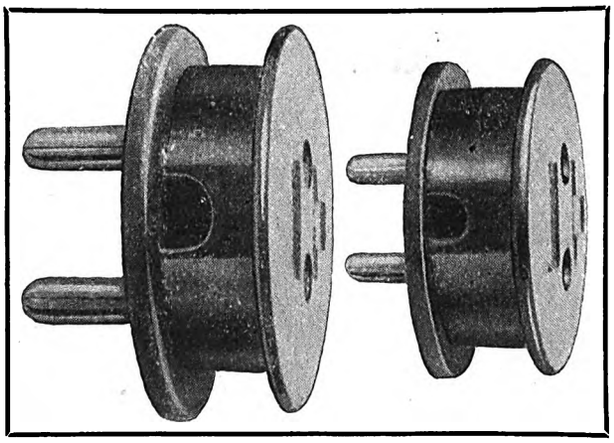

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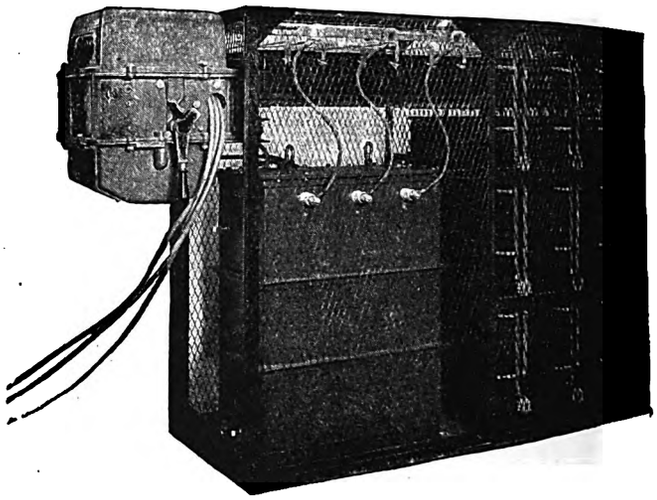

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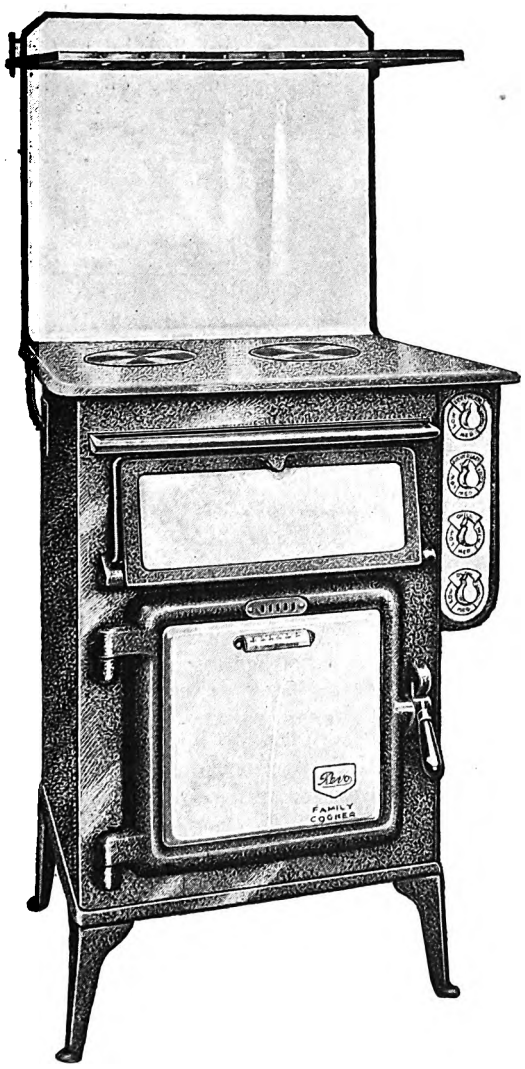

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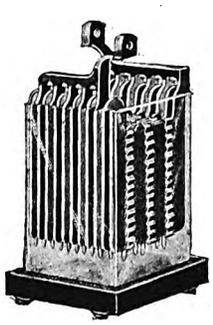

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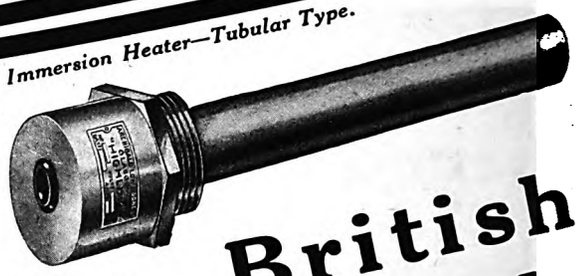

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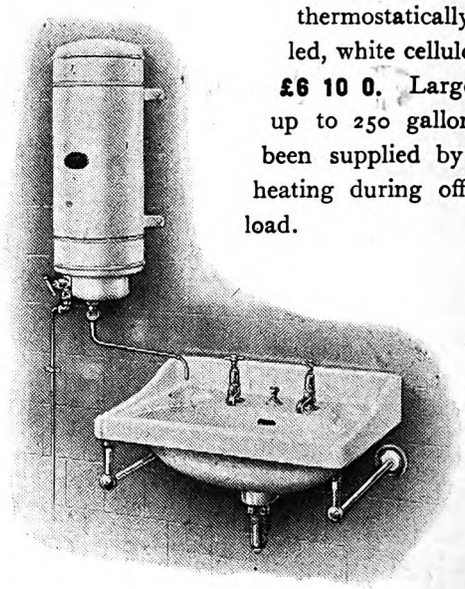

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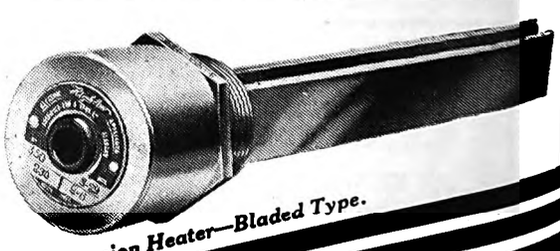

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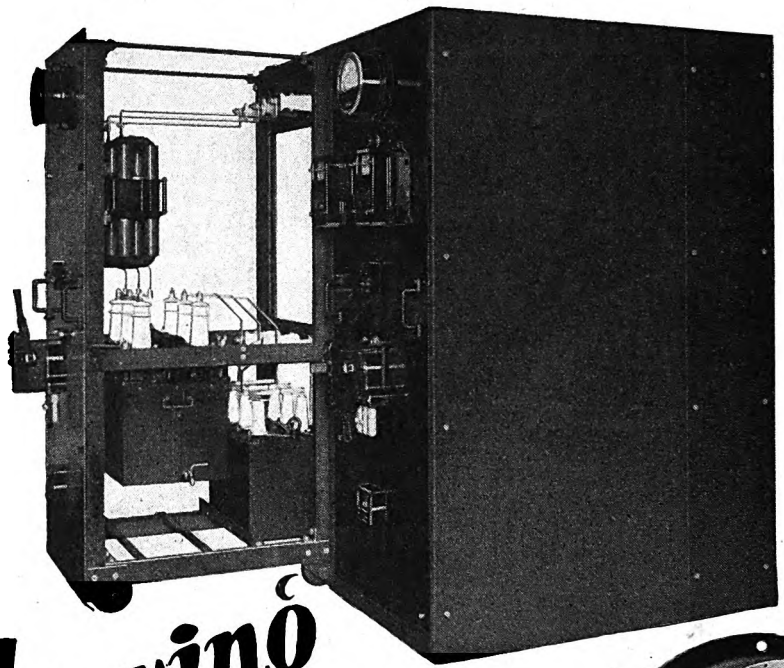

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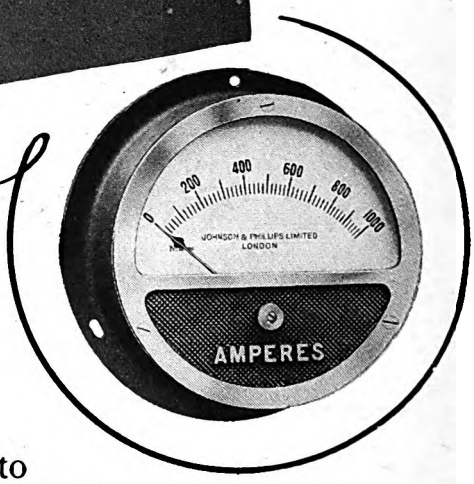

The reliability of J. & P. Switchgear is not confined to the certainty of protection it gives your circuits. It extends to the readings given by the indicating instruments on the board—not only when on test in the works, but also on site, when they have withstood the handling inseparable from transport and erection.

With J. & P. Instruments you can believe what you see indicated on the dial. They are made in our own Instrument Department, by craftsmen of long experience, to the highest standards of accuracy for their class.

Responsibility for Switchgear and Instruments is undivided when you place an order with J. & P.

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Branches throughout the Provinces and the Empire.

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The Wiring of London

Another of our series of important new London buildings wired with

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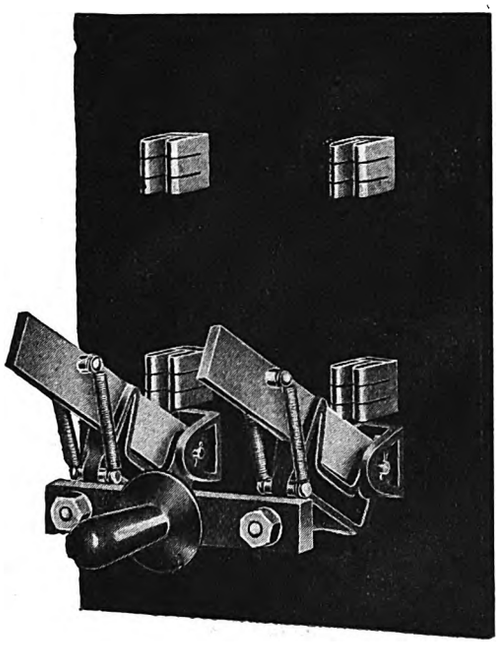
THE "WECOL" KNIFE SWITCH

(Dead Hinge Type)



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Simplest in Construction—
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In every detail of design and construction the "Wecol" Knife Switch is built to the highest standard of Electrical and Mechanical Efficiency.

It possesses the added advantage of occupying less space than many others of the same Electrical Capacity.

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are of best High Conductivity Copper. Capacity rating to I.E.E. Regulations and British Standard Specification.

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are of Moulded Non-flammable Material of highest possible insulation. Polished Ebony Finish.

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Best Malleable Castings all drilled to Jigs and interchangeable.

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Send to-day for the 'Book of Apex' giving the full range of 'APEX' Switches and Distribution Boards illustrated and described, together with particulars of price reductions.

If you would like to see a representative, you may rest assured of intelligent co-operation in your requirements

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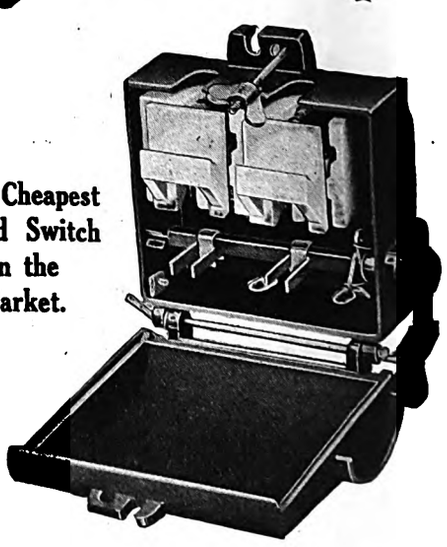
BRANCHES: Birmingham, Bristol, Glasgow, Leeds, Liverpool, Manchester, Newcastle, Sheffield, S. Wales.
Established 1903.

The Cheapest Fused Switch on the Market.



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List price **3s. 10d.** each for gross lots.
Prices quoted for smaller quantities on application.

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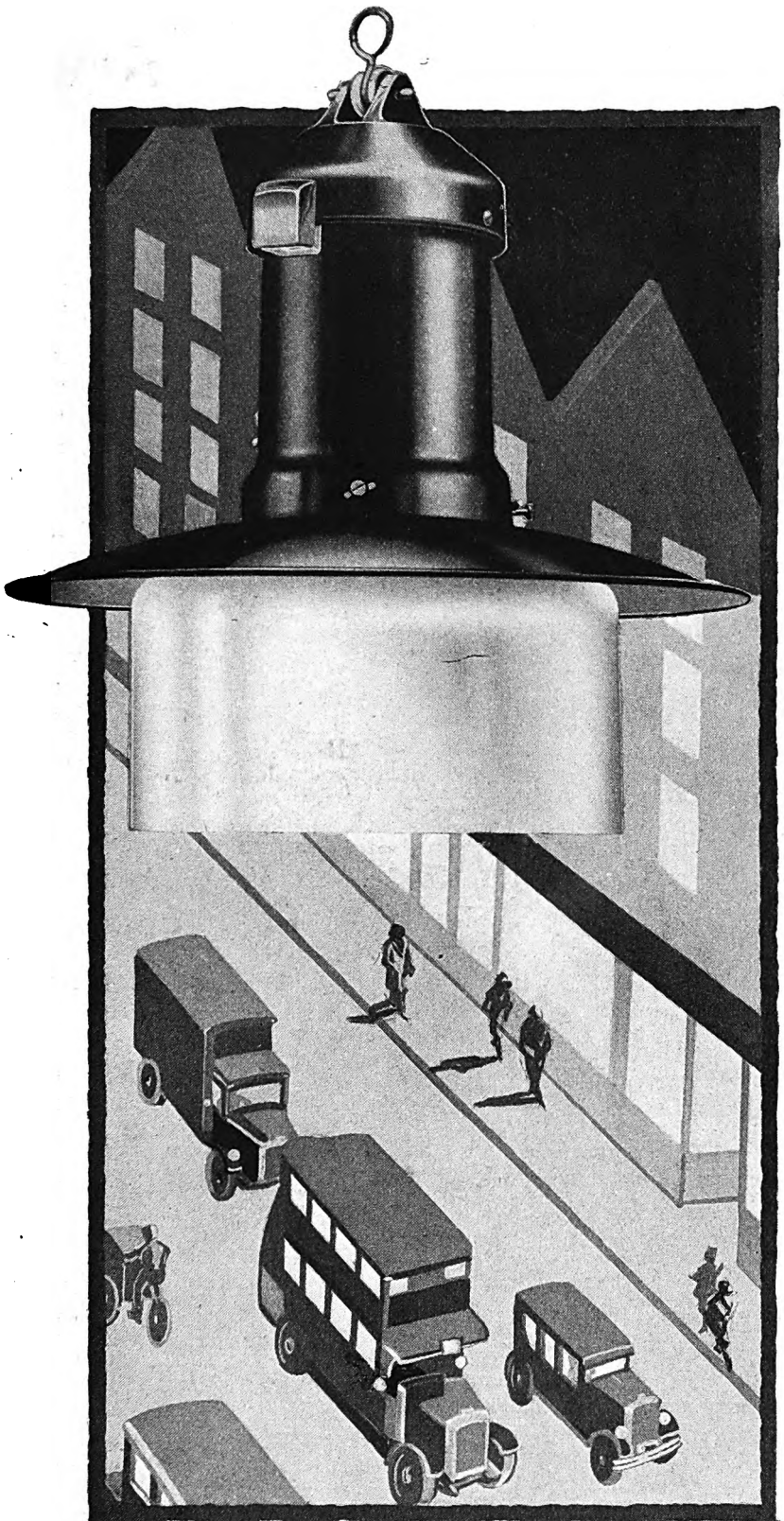

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Modern street lighting conditions demand fittings of quality. Those in the Philips range combine efficiency with good appearance.

Type N.A.35 illustrated above represents the latest achievement in street lighting fittings. The cylindrical globe of three ply opal glass concentrates most of the light on the road and also illuminates adjacent buildings with diffused light giving a very pleasant appearance to main thoroughfares.

A patent device ensures the lamp being in the correct focal position.

The fitting is sent out completely wired and it is only necessary to connect the lead-in wires to the terminal blocks incorporated in the cast iron canopy. The wires from these terminal blocks to the holder are insulated with fish beads, no rubber (which is liable to perish) being used.

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Made by the Manufacturers of the famous Argenta Lamps and All-Electric Radio Receivers and Neon Signs.

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ADVERTISERS will please note that NEW COPY and ALTERATIONS to existing Advertisements (with Blocks) should reach here not later than

THURSDAY MORNING

OF THE WEEK PREVIOUS TO ISSUE.

OFFICIAL NOTICES, PATENT NOTICES, SITUATIONS VACANT, SITUATIONS WANTED, PARTNERSHIPS, AGENCIES, ARTICLES FOR SALE, ARTICLES WANTED, ETC.

Latest Time 5 p.m. TUESDAY.

The ELECTRICAL REVIEW is the recognised Medium of the Electrical Trades, and has BY FAR THE LARGEST CIRCULATION of any Electrical Industrial Paper in Great Britain.

THE "ELECTRICAL REVIEW'S" SUGGESTIONS for dealing with

Apparent Death from Electric Shock

should be in every Generating, Transforming and Motor House.

Mounted on Cardboard, 1/6 each. Post free. 2s. 3d.

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WHEATLEY KIRK, PRICE & CO.

Have for close upon 80 years Specialised in

VALUATIONS AND SALES BY AUCTION of Electrical Works, Plant and Equipmont.

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ZURICH: E. Rascher & Cie, Rathausquai 20.

ELECTRICAL POWER ENGINEERS' ASSOCIATION

Scarborough Corporation.

NOTICE is given of the existence of a difference between the above Corporation and the Association relative to the dismissal of a member, which difference has been referred to the National Joint Board.

CONSEQUENT UPON this Dispute, and pending a settlement, MEMBERS OF THE ASSOCIATION ARE ENJOINED TO REFRAIN FROM APPLYING FOR OR ACCEPTING ANY APPOINTMENT WITH THE ABOVE CORPORATION.

W. ARTHUR JONES, A.M.I.E.E.,
General Secretary.

102, St. George's Square,
London, S.W.1. 3333

SITUATIONS VACANT.

Latest time for receiving 5 p.m. Tuesday.

If letters are not to be delivered to certain firms or individuals (if known), instructions to that effect should be sent to the Manager of the ELECTRICAL REVIEW, who will do his best to carry out such instructions. Letters of applicants cannot in such cases be returned to them, nor can the names of Advertisers using a number in any way be disclosed.

Original Testimonials should never be sent.

CITY OF CHESTER.

Engineer for Development of Showroom and Use of Electricity.

APPLICATIONS are invited from Electrical Engineers who have had a technical education and training and practical experience in the application of electricity for domestic, business and industrial purposes, management of showrooms, and generally in promoting the extensive use of electricity by consumers.

Salary £300 per annum, rising, subject to satisfactory service by increments of £25 to a maximum of £400 per annum.

The successful candidate will be required to undergo a medical examination and contribute to the Council's Superannuation Scheme.

Applications, stating age, details of education, technical training and experience, with copies of recent testimonials, to the undersigned on or before December 30th, 1929.

J. H. DICKSON,
Town Clerk.

Town Hall, Chester.
December 14th, 1929. 3777

CITY OF SALFORD.

Electricity Department.

APPLICATIONS are invited for the position of Junior Assistant Mains Engineer, salary in accordance with N.J.B. Schedule, Grade 10.B, Class H, present value £211 13s.7d., subject to deductions for Superannuation Scheme after twelve months' satisfactory service.

Thorough technical training is essential, and experience in surveying and estimating for mains extensions and services desirable.

Applications, stating age, training and experience, to the City Electrical Engineer, Frederick Road, Salford, not later than January 10th, 1930.

3798 H. H. TOMSON, Town Clerk.

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SITUATIONS VACANT.—*Continued.*

COUNTY BOROUGH OF WEST HARTLEPOOL.

Appointment of Borough Electrical Engineer.

APPLICATIONS are invited from qualified Electrical Engineers, who must have sound commercial ability and experience, for the position of Borough Electrical Engineer, upon forms to be obtained from me which must be delivered duly completed and endorsed "Borough Electrical Engineer" at the Municipal Buildings, West Hartlepool, not later than Saturday, the 11th January 1930.

The salary, which will be in accordance with the National Minimum Scale of Salaries for Chief Electrical Engineers of authorised Electricity Supply Undertakings, amounts to £1,125 for the current year.

The person appointed will in all probability be appointed to the position of Transport Manager which would carry with it an additional salary of £150 per annum.

Canvassing directly or indirectly will be a disqualification.

HAROLD W. STANTON,
Town Clerk.

Municipal Buildings,
West Hartlepool,
December 20th, 1929. 3812

CITY OF MANCHESTER.

Electricity Department.

POWER STATIONS ENGINEER.

THE Electricity Committee of the Manchester Corporation invite applications for the position of Power Stations Engineer.

Experience in large power station operation is essential, and candidates must be Corporate Members of either the Institution of Electrical or Mechanical Engineers.

Commencing salary: £900 per annum, rising to £1,000, by annual increments of £50.

Applications, giving full particulars of technical training, experience and age, together with copies of recent testimonials, must be endorsed "Power Stations Engineer," and reach the undersigned not later than 10 o'clock a.m. on Saturday, January 4th, 1930.

F. E. WARBRECK HOWELL,
Town Clerk.

Town Hall, Manchester.
December 17th, 1929. 3799

CITY OF NORWICH.

Electricity Department.

MAINS ASSISTANT.

APPLICATIONS are invited for the position of Assistant in the Mains Department.

Applicants must have had technical training and experience in the erection of overhead high and low tension mains.

Salary in accordance with N.J.B. Schedule, Class G, Grade 9a (present value £251 3s. 2d. net).

Applications, stating age, and giving full particulars, together with copies of testimonials, to be sent to the undersigned.

F. M. LONG,
City Electrical Engineer.

Corporation Electricity Works, Duke Street, Norwich.
December 17th, 1929. 3796

BATTERSEA BOROUGH COUNCIL.

Electricity Department.

WANTED.—Cable Jointers with experience in working on live low tension mains.—Apply in writing, giving full particulars of experience and when able to commence duties, to the Borough Electrical Engineer, Electricity Works, Lombard Road, Battersea, S.W.11. 3805

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

AN extra £2 to £5 weekly can be easily earned by men of ambition and initiative; clerical work only; no canvassing or selling.—6403, Electrical Review, 4, Ludgate Hill, London.

ASSISTANT Electrical Designer required, with experience of direct current design up to 300 kW; a.c. experience an advantage.—Apply, stating age, training and salary required, with copies of testimonials, to Sunderland Forge & Engineering Co., Ltd., Pallion, Sunderland. 3720

ASSISTANT required in design office. Applicants must have technical college training and workshop training and some practical experience in a design office.—Apply in writing, stating experience, training and salary required, to the Chief Designer, G.E.C. Engineering Works, Witton, Birmingham. 3731

SITUATIONS VACANT.—*Continued.*

ASSISTANT Technical Engineer wanted for well-known company in the electrical industry. Good technical knowledge and practical experience necessary.—State experience and salary required to 3801, Electrical Review, 4, Ludgate Hill, London.

BAKELITE and moulded productions. Birmingham firm desire to appoint Representative; must have sound connection for small articles.—6417, Electrical Review, 4, Ludgate Hill, London.

CANVASSER required to obtain new consumers and push assisted wiring scheme in a rural district of Kent and East Sussex, comprising over 450 square miles. Applicants should be unmarried. Remuneration on salary and commission basis.—Apply, giving full particulars, to The Weald Electricity Supply Co., Ltd., Hawkhurst, Kent. 3803

DRAUGHTSMAN, designing and estimating, experience electric furnace work.—Give full details experience, salary required, to 3795, Electrical Review, 4, Ludgate Hill, London.

DRAUGHTSMAN, Senior, with good experience of a.c. and d.c. motors and generators.—Applications, stating age, experience and salary required, to 3758, Electrical Review, 4, Ludgate Hill, London.

DRAUGHTSMAN required with experience on the layout of control gear for automatic sub-stations.—Apply, stating age, full experience and salary required, to Switchgear Department, General Electric Co., Ltd., Witton, Birmingham. 3811

DRAUGHTSMEN required, with experience on high and low tension switch cubicles, &c.—Apply, stating age, full experience, and salary required, to the Switchgear Department, General Electric Co., Ltd., Witton, Birmingham. 3773

DRAUGHTSMEN wanted; good knowledge of P.O., P.B.X., switchboards, automatic telephone switchboards and general experience of electrical apparatus. Only those with initiative and energy need apply.—Write full details of practical and theoretical training, &c., and salary required, to 3699, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Testers for trunk telephone cable installation work required shortly by large firm. Starting salary £3 to £4 per week; living allowance 35s. per week home and liberal rate abroad.—Write, giving qualifications, experience and age, to 3809, Electrical Review, 4, Ludgate Hill, London.

ENGINEER'S Draughtsmen wanted for electro-mechanical instruments. Sound modern production methods backed by experience. Knowledge of telegraph-telephone practice desirable. Good prospects for right men.—Apply by letter only, giving fullest particulars, to Creed & Co., Ltd., Telegraph Works, East Croydon. 3761

EXPERIENCED Shorthand-typist, used to the electrical trade, required for small works, W.3 district.—Write, giving particulars of previous or present employment and state salary required, to 3810, Electrical Review, 4, Ludgate Hill, London.

LABORATORY Assistant (Junior); technical training and knowledge of electrical testing; knowledge of h.f. measurements an advantage.—Write full details, age and salary required, to 3774, Electrical Review, 4, Ludgate Hill, London.

METROPOLITAN Vickers Electrical Company, Ltd., Trafford Park, Manchester, requires a Designing Draughtsman for switchgear Must be neat, quick and accurate, and have had experience in the designing of switchgear for all voltages. State training. experience, and salary required.—Apply by letter, addressed to the Company's Employment Department, marked "Switchgear Draughtsman." 801

REPRESENTATIVES required for London and also S.E. England for sales of electric tools. Salary and expenses. Good connection essential.—6453, Electrical Review, 4, Ludgate Hill, London.

REPRESENTATIVES wanted, all districts, for new lines in British made electric lamps, Neon and electric signs.—6454, Electrical Review, 4, Ludgate Hill, London.

REQUIRED by large manufacturing concern, First-Class Illuminating Engineer, with knowledge of industrial and commercial electric light fittings. Must have first-class connections amongst architects.—Write, stating age, experience, salary required, &c., to 6479, Electrical Review, 4, Ludgate Hill, London.

SALES Engineer required, with experience in selling and demonstrating modern electric welding equipment and chromium plating plants, with connections among shipyards, constructional engineers and works, &c.—Write, giving fullest particulars, to Fredk. J. Gordon & Co., Ltd., 92, Charlotte Street, London, W.1. 3807

SHOP Foreman required for coil winding (wireless and instrument); must have previous experience, London district.—Reply, stating age, experience, and salary required, to 3765, Electrical Review, 4, Ludgate Hill, London.

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SITUATIONS VACANT.—*Continued.*

SALESMAN required for electric fires, cookers and domestic appliances in the Manchester District. Must have a good conection with the trade and previous experience in these lines. Liberal commission and good prospects for suitable man. Apply immediately with full information as to past experience, to 3813, Electrical Review, 4, Ludgate Hill, London.

TESTER for a.c. and d.c. motors up to 300 h.p. Good wages and progressive situation for really good man.—Veritys, Ltd., Plume Street, Aston, Birmingham. 6482

TESTERS.—Vacancies exist for senior and junior men on transformer test staff; West Middlesex.—Applicants should state age, experience and wages, to 3721, Electrical Review, 4, Ludgate Hill, London.

THE Lancashire Dynamo & Motor Co., Ltd., Trafford Park, Manchester, have vacancies for experienced Testers, a.c. and d.c. State experience and salary required with application. 3808

TRAVELLER wanted, already calling on contractors and wholesale electrical traders in North-Eastern Counties, to handle good side line on commission.—3800, Electrical Review, 4, Ludgate Hill, London.

TURBINE Engine Driver required immediately; thoroughly experienced in high-speed turbine work (preferably Brush machines). J.I.C. Schedule wages, 66s. per week.—Applications, with full particulars, and stating when duties can be commenced, together with copies of testimonials, to be addressed to the Borough Electrical Engineer, Electricity Works, Tunbridge Wells. 3815

TWO Representatives wanted, one Glasgow and one Manchester district, by electrical manufacturers, to call on collieries and works. Commission and part expenses basis. Full particulars first letter.—6486, Electrical Review, 4, Ludgate Hill, London.

TWO Charge-hands wanted, experienced in coil-making, for rotors and stators of turbo-alternators. North-East Coast.—Reply, stating age, experience and wages required, to 6475, Electrical Review, 4, Ludgate Hill, London.

WANTED, by large manufacturing concern, a live and energetic man, one with extensive connections amongst architects, to act as Representative.—Write, stating age, experience, salary required, &c., to 6480, Electrical Review, 4, Ludgate Hill, London.

WANTED for Calcutta, E.H.T. Cable-Jointer. Experience in laying and jointing of 3-core paper lead-covered and wire armoured cables essential. Terms:—Agreement for five years, with salary of Rs. 545 monthly, rising to Rs. 685 monthly by annual increments; free quarters or house allowance in lieu thereof; free second class passage to Calcutta and back; liberal leave rules, and other advantages.—Applications, stating age, and giving full particulars of previous experience and qualifications, together with copies of testimonials, should be addressed to the Secretary, Calcutta Electric Supply Corporation, Ltd., No. 3 & 4, Clements Inn, Strand, W.C.2. 3792

APPOINTMENTS FILLED.

Dissatisfaction having been so often expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision. We will then insert a notice free of charge under this heading.

ELECTRICITY Distribution of North Wales & District, Ltd. (Assistant Mains Engineer); Box 3606 (Mains Assistant); Box 3607 (Jointer).

SITUATIONS WANTED.

REPRESENTATIVE OR SALES MANAGER.

MANAGER (40), late branch sales manager and general manager for one of the largest electrical manufacturing companies for Yorkshire, is open for offers as Representative or Sales Manager. Last 15 years as sales, branch and general manager specialising in the sale of industrial electrical plant and its application.—Will interested parties write in first instance to Box 2038, Williams's Advertisement Offices, 29, Kirkgate, Bradford. 6406

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

ADVERTISER (43), with wide manufacturing, commercial, and sales experience. For past 15 years managing director of works. Travelled U.K. and U.S.A. and Canada. Desires change to London representative, commercial manager, or buyer.—6503, Electrical Review, 4, Ludgate Hill, London.

ARMATURE Winder (20) seeks situation; six years' experience a.c. and d.c., new and repair, all sizes; also maintenance.—F. Harbar, 16, Kingsley Avenue, Hounslow. 6410

SITUATIONS WANTED.—*Continued.*

ARMATURE Winder, a.c. and d.c., &c.; 18 years' experience. All classes.—H. E., 488, Baring Road, Lee, S.E.12. 6446

ASSISTANT Engineer (32) to supply undertaking seeks appointment as Manager. Experienced and capable services to offer, with specialised knowledge of bulk supply and l.t. distribution. Likewise commercial development, domestic electrification, and industrial power applications. Successful record of business management. N.B.—A business getter, with progressive vision in the direction of revenue sources and undertaking prosperity. About £350 per annum. —6471, Electrical Review, 4, Ludgate Hill, London.

ASSISTANT Mains Engineer. Secondary school education. Experience e.h.t., l.t., d.c., all systems. Age 28, two years apprentice (mechanical), four years power stations, five years mains.—6472, Electrical Review, 4, Ludgate Hill, London.

BARRISTER (25), Oxford graduate, experience in patents, requires post with firm.—6414, Electrical Review, 4, Ludgate Hill, London.

BUYER, wide practical and commercial experience, electrical apparatus and small engineering, desires appointment.—6442, Electrical Review, 4, Ludgate Hill, London.

CAPABLE Electrician, young, maintenance, breakdowns, installations of motors, lifts, &c.—6489, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Apparatus Designer (small current), excellent qualifications, seeks engagement; many years' experience; able and responsible. Would undertake part-time work drawing, calculating or writing.—E. Sanftleben, 78, Hurstbourne Road, S.E.23. 6485

ELECTRICAL Fitter and Erector, used to 33,000-volt switchgear, wants practical technical training; wages, 1s. per hour.—6501, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Improver seeks situation; experience lighting, &c.—K. Sharp, 9, Chancellor's Road, Hammersmith. 6402

ELECTRICIAN, good, wants work; good reference.—6437, Electrical Review, 4, Ludgate Hill, London.

ELECTRICIAN, lighting, power installations, jobbing. Experienced mechanic.—"Electric," 325, Kilburn Lane, W.9. 6481

ELECTRICIAN (41), 25 years' experience with good reference. Maintenance of factory preferred. 8, Denton Street, S.W.18. 6487

ENGINEER, A.M.I.E.E., experienced planning, specifying, and carrying through large works equipment; previous positions as chief assistant, consultants, resident engineer, tramways, electrical engineer in large works, &c. Accustomed to responsibility for steam and gas power station operation, maintenance of works plant, costs, wages, correspondence, &c., and some commercial work; desires appointment.—6502, Electrical Review, 4, Ludgate Hill, London.

ENGINEER (26), desires situation home or abroad; experienced in erection and maintenance of power plant, some knowledge of Spanish.—6483, Electrical Review, 4, Ludgate Hill, London.

ENGINEER, A.M.I.E.E., 17 years' experience in the design, manufacture, erection and sales of heating, cooking and domestic apparatus, both large and small, desires position either commercial or manufacturing.—6500, Electrical Review, 4, Ludgate Hill, London.

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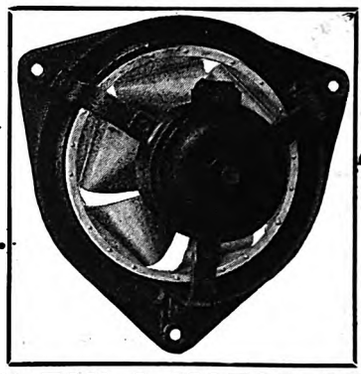

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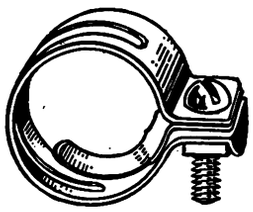

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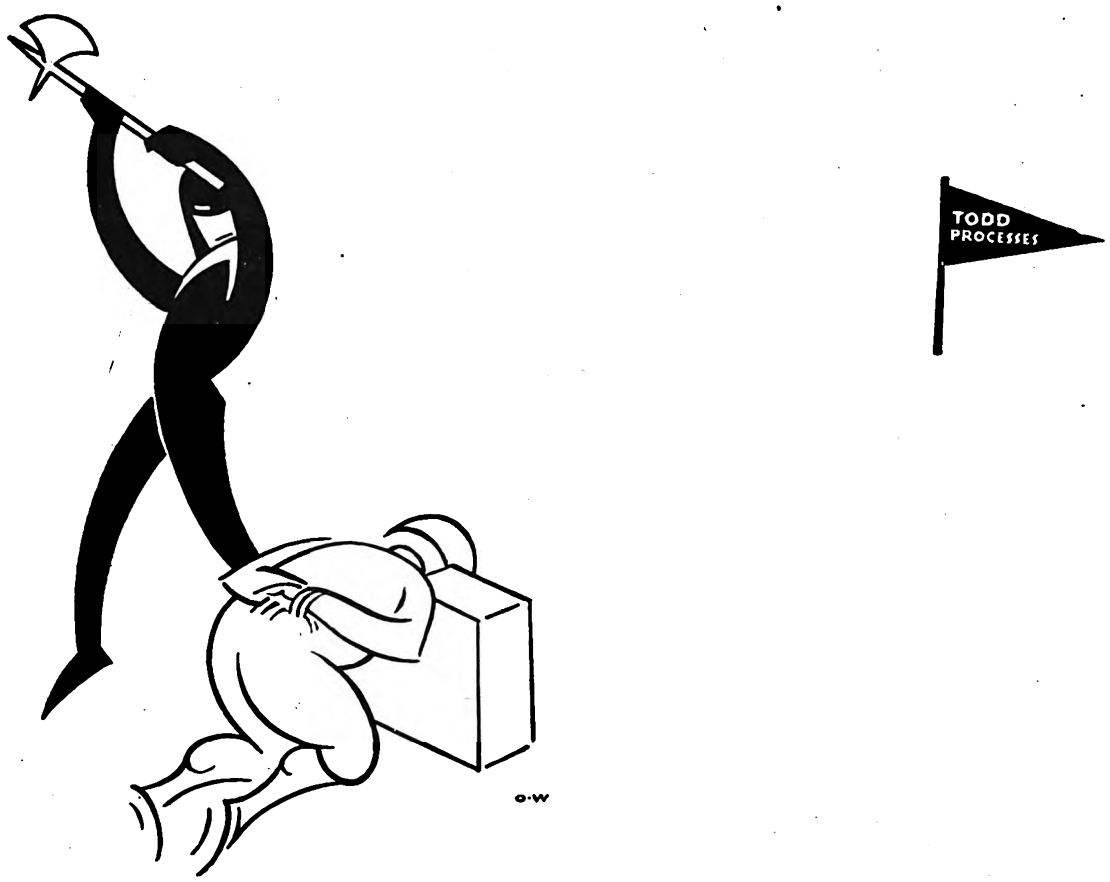

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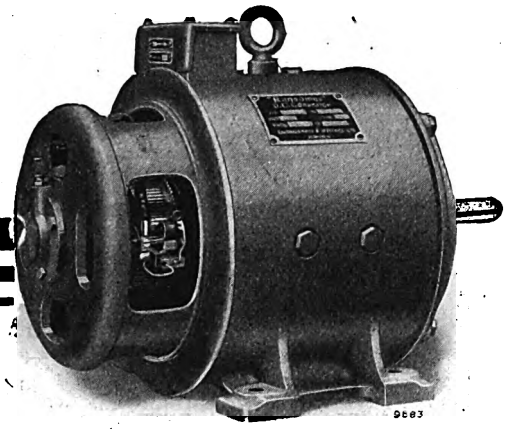

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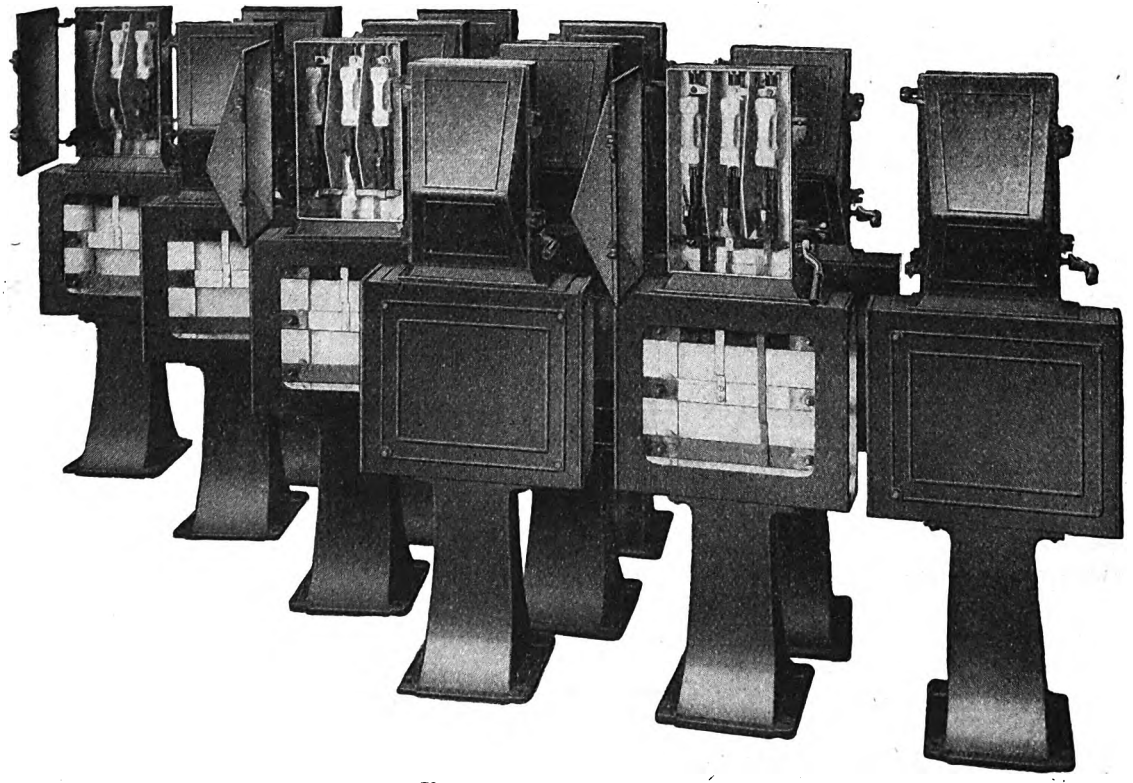

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Warwick Works, 46, Coventry Road, BIRMINGHAM.

Estbd. **LONDON, W.1.** | **28, West Campbell Street, GLASGOW.** | *1832.* **NEWCASTLE-ON-TYNE.**

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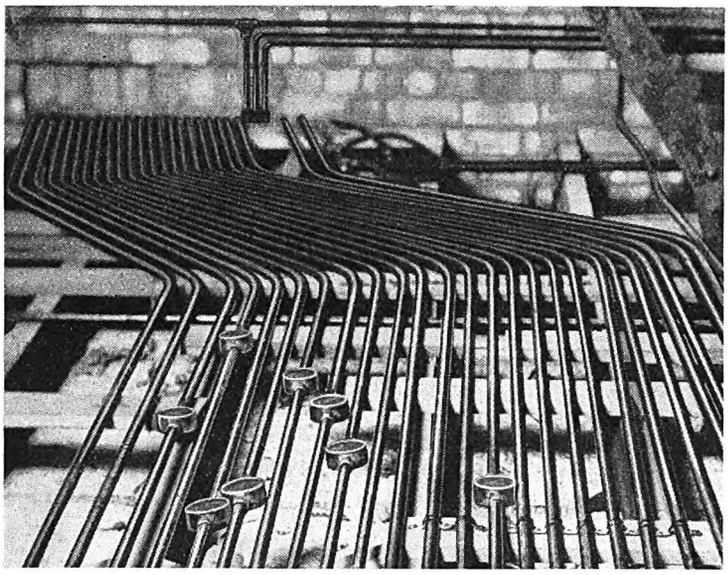
A striking instance of the use of



The roof of the Regal Theatre, Handsworth, showing a few of the Metallic Steel Conduits used exclusively by Messrs. Parker, Winder & Achurch, Ltd., Birmingham, for the installation.

METALLIC STEEL CONDUITS

in a recent installation

— one of many — calling for exceptional efficiency. Note the bends in the tubes proving the quality and adaptability of Metallic Steel Conduits. Give them a trial in your next big contract—you will be delighted with the result and your wiremen will appreciate their labour saving qualities. Metallic Steel Conduits Fittings should also be used to ensure a perfect job.

METALLIC SEAMLESS TUBE CO. LTD
LUDGATE HILL
BIRMINGHAM

Telephone: CENTRAL 7167.

Telegrams: "FLASK, B'HAM."

The Cooker with IRONCLAD *Elements*

The point of similarity between a battleship and a "Met-Vick" Cooker is that the vital parts of both are protected by steel enclosure.

You cannot touch the actual heating wires of a "Met-Vick" Cooker either by accident or intent. Boiling Plates, Grill, and Oven Elements are completely protected and safe from damage due to grease or spillings.

Enclosed yet insulated, protected yet efficient, the "Met-Vick Ironclad" leads the way in Electric cooker design..

Three points for the reseller

(1) PRICES ARE LOW.

Prices have recently been reduced, and now range from

£10 6 0 to £19 4 0

(Even lower prices if fitted with open type grill elements).

(2) CONVENIENT HIRE-PURCHASE TERMS.

Resellers can offer "Met-Vick" Cookers on hire-purchase terms, assured of their discount as soon as delivery is effected.

(3) TEST AND APPROVAL.

"Met-Vick" Cookers have been tested and approved by the *Good Housekeeping Institute* and each cooker bears their seal, as reproduced herewith.

Tested and Approved 491 Good Housekeeping Institute Conducted by Good Housekeeping Magazine

MET-VICK ELECTRIC COOKER

Metro-Vick Supplies (Proprietors: Associated Electrical Industries, Ltd.) **155, Charing Cross Road, London, W.C.2.**

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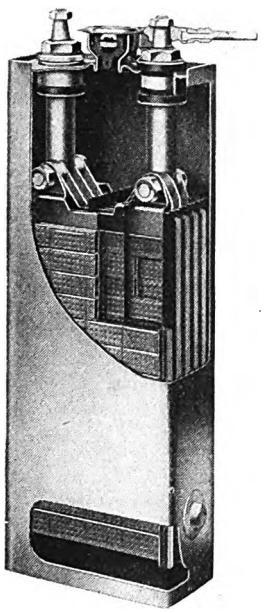
Before you buy a Battery —



"NIFE" CELL IN SECTION.

Try and foresee your opinions at the end of its life. Will you feel satisfied that it cost you the lowest possible amount per mile? Or will an attractive first cost have been trebled in repairs and early renewals?

Will it be 2 or 3 years hence before you are considering its successor or will it be 10 years?

If this attractive "first cost" has to be repeated four times in the next ten years, where does value come in?

But suppose you spend a little more to-day and the same old battery is still going strong in 10 years. Imagine your frame of mind—"a good bargain that—wonderful good service."

Many users are saying that to day; they bought—and buy—**"Nife"** batteries. Others are dissatisfied—they didn't!

"Nife"—Always fitted where only the best will do!

NI+FE ACCUMULATOR

BATTERIES LIMITED
REDDITCH

London Office: 220, Shaftesbury Avenue, W.C.2

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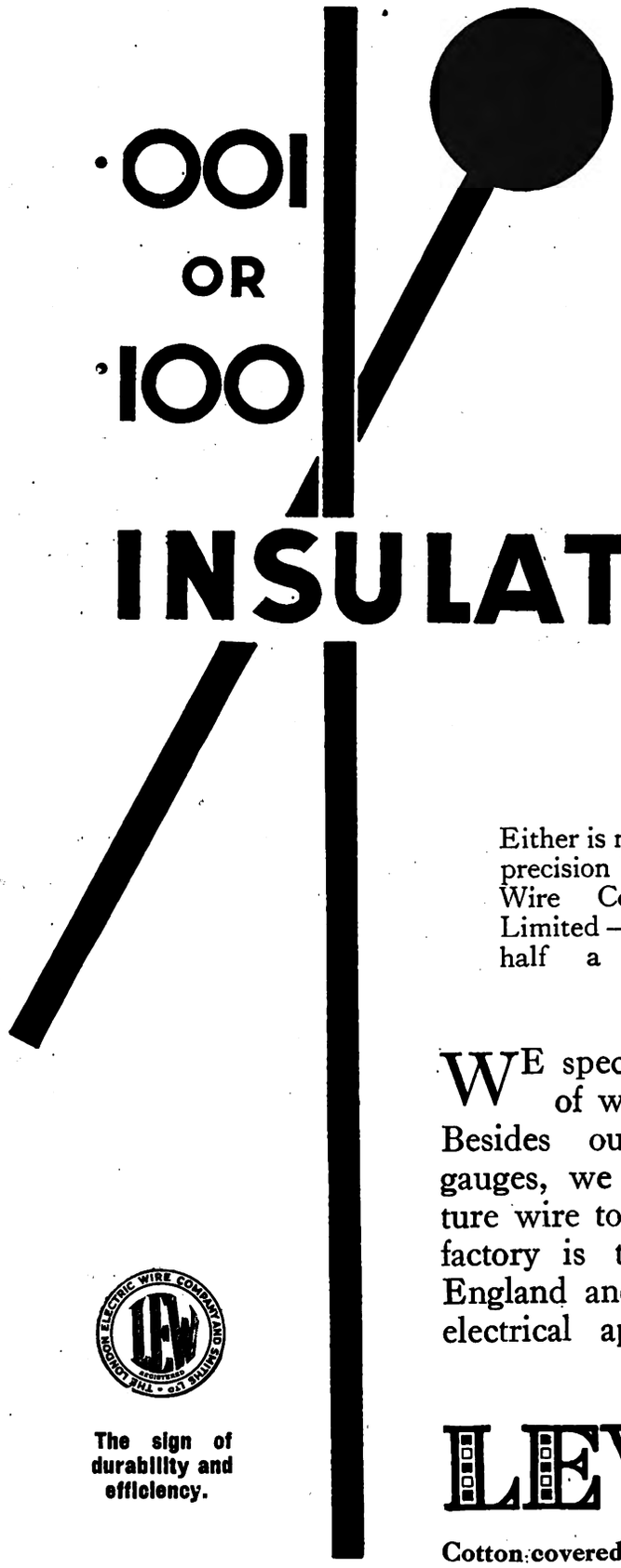

INSULATED WIRE

Either is manufactured with equal precision by the London Electric Wire Company and Smiths Limited — the Company with half a century's experience.

WE specialise in the production of wire of every description. Besides our stock of standard gauges, we undertake to manufacture wire to any specification. Our factory is the most up-to-date in England and can produce wire for electrical apparatus of all kinds.

The sign of durability and efficiency.

LEWCOS
REGD.

Cotton covered, silk and enamel insulated Wire.

THE LONDON ELECTRIC WIRE COMPANY AND SMITHS LIMITED

CHURCH ROAD, LEYTON, LONDON, E.10.

Trade Counter: Playhouse Yard, Golden Lane, London, E.C.1.

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There's an "R" in the month!

MONTHS with an "R" in their name mean Oysters are in demand as well as Cosmos Pearl Lamps. The Cosmos Simplified Pearl Line is never more readily sold than when oysters are seen in the shops.

You will find attractive dealers' helps, and a specialized advertising Campaign, do much to stimulate the consumers' natural appetite for—

COSMOS PEARL LAMPS

Concentrate on "Cosmos" Pearl Lamps for the GLARELESS LIGHTING CAMPAIGN

Send for copy of new Trade Brochure

Metro-Vick Supplies, Metro-Vick House, 155 Charing Cross Rd., London, W.C.2.
(Proprietors: Associated Electrical Industries Ltd.)

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OFFICIAL NOTICES.

Latest time for receiving, 5 p.m. Tuesday.

COUNTY BOROUGH OF GRIMSBY.

Electricity Department.

THE Corporation of Grimsby are prepared to receive Tenders for the manufacture, delivery, and complete erection of

ONE 10,000 KILOWATT, THREE-PHASE TURBO-ALTERNATOR, WITH CONDENSING PLANT.

The Specification and Form of Tender can be obtained from Mr. S. R. Windle, Electricity Offices, Moss Road, Grimsby, upon payment of a deposit of £2 2s. (two guineas). The deposit will only be returned after a *bona fide* Tender has been opened by the Committee, and after the Specification and Form of Tender has been returned intact.

Sealed Tenders, endorsed "Tender for Works Plant," must be delivered to the undersigned not later than noon on Thursday, the twenty-third day of January, 1930.

The Corporation do not bind themselves to accept the lowest or any Tender.

S. R. WINDLE,
Borough Electrical Engineer.

Electricity Offices, Moss Road, Grimsby.
December 16th, 1929. 3797

SOUTH INDIAN RAILWAY COMPANY, LIMITED.

THE directors are prepared to receive tenders for the supply of:—

MADRAS IMPROVEMENTS—ELECTRIFICATION.

1. Cables and Accessories.

Specifications and forms of tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W.1.

Tenders addressed to the Chairman and Directors of the South Indian Railway Co., Ltd., marked: "Tender for Cables and Accessories," with the name of the firm tendering, must be left with the undersigned not later than 12 noon on Friday, January 24th, 1930.

The directors do not bind themselves to accept the lowest or any tender.

A charge, which will not be returned, will be made of £1 for each copy of the specification.

Copies of the drawings may be obtained at the offices of the Company's Consulting Engineers, Messrs. Robert White and Partners, 3, Victoria Street, Westminster, S.W.1.

A. MUIRHEAD,
Managing Director.

91, Petty France,
Westminster, S.W.1.
December 18th, 1929. 3804

THE ELECTRICAL TRADES BENEVOLENT INSTITUTION

Founded 1905.

OBJECTS:

To assist all deserving and necessitous persons who are or have been engaged in the Electrical Trade in the United Kingdom as employers, managers, teachers, or on the engineering, designing, drawing, sales or office staff, or in any other similar capacities, or their dependents.

YOU SHOULD JOIN.

Subscription Rates:

ASSOCIATE - - 5/- yearly.
MEMBER - £1 : 1 : 0 yearly.

Full particulars sent on application to:—

The SECRETARY,
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Advertisements are inserted under this heading at 14s. per inch.

INTERNATIONAL CORRESPONDENCE SCHOOLS.
School of Electrical Engineering.

THIS Institution—the largest in the world devoted to spare-time training—has complete Courses of Instruction to cover the

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and the
Limited Competition for Probationary Asst. Eng., G.P.O.

Other courses meet the requirements of all who desire a thoroughly practical and profitable technical education, and all who wish to qualify for positions in the Design Office, Test Room or Drawing Office, or as Chief Engineers, Assistant Engineers, Shift Engineers, or Switchboard Attendants in Electric Power, Light and Traction Stations Equally successful is our instruction for Telegraph and Telephone Engineers, Telegraphists, and Telephonists.

All instruction is by correspondence from text-books specially prepared by many experts for tuition by post.

Prospectus post free from
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55, International Buildings, Kingsway, London, W.C.2.
2013

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PATENT FOR SALE OR LICENSE.

THE Proprietor of British Patent No. 283,221 is prepared to sell the patent or to license British manufacturers to work thereunder. It relates to battery separators made of wood. Address:—

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Illustrations!

BLOCKS intended for use in the Advertisement Pages of the "Electrical Review" should not exceed 120 screen.

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ASHFORD, DUNN & CO., LTD.,
RYDE AVENUE, HULL.
Teleg.: "Mantel, Hull." *Telep.*: 7577 Central.
Manufacturers of every description of Slate and Marble Work for Electrical Purposes.

HOOPER'S
Telegraph & India-Rubber Works, Ld.

ADELAIDE HOUSE,
King William Street, E.C.4.
(Established 1860.)

MILLWALL DOCKS,
LONDON, E.14.

PURE TAPE AND STRIP, &c., &c.

HOOPER'S Vulcanised India-Rubber Cables for Electrical Work maintain the highest quality, and their durability has been proved.

Telegrams: LINEAR, London. Telephone: Mansion House 6626.

F. WIGGINS & SONS.
MICA FOR INSULATION.
Telephone: Royal 8029
Largest Stock in the World
102, 103 & 104, Minories, LONDON, E.C.

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SOLID STRANDED

THE GALVANIZED WIRE THAT WILL WRAP ON ITSELF WITHOUT FLAKING OR PEELING AND CONFORM TO B.E.S.A. SPEC'N.

JOHNSONS' CRAPO
(PATENTED)

Galvanized Iron and Steel Wires for Conductors and Earths,

AS SPECIFIED BY POWER ENGINEERS.

THE GALVANIZED WIRE THAT WILL WRAP ON ITSELF WITHOUT FLAKING OR PEELING AND CONFORM TO B.E.S.A. SPEC'N.

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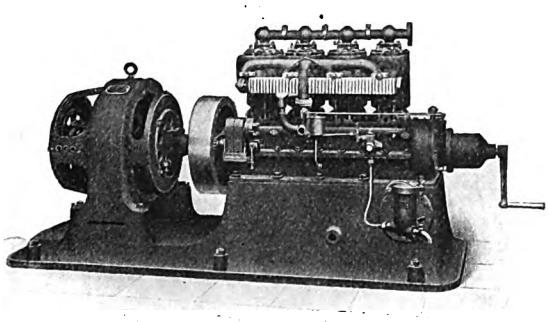
FOR ALL PURPOSES.

RICHARD JOHNSON & NEPHEW, LTD., Bradford Iron Works, **MANCHESTER.**

Ambergate Wire Mills, nr. DERBY. | 22/26, Broad Street Avenue, Blomfield Street, London, E.C.2. | Exchange Bdgs., Stephenson Place, BIRMINGHAM.

OIL ENGINES **Pelapone** LIGHTING SETS



10 kW. 4-cylinder Ship's Emergency Plant.

PELAPONE Electric Generating Plants range from 1 kW to 30 kW. They are of the vertical, four-cycle, heavy-duty type and have achieved an international reputation for high quality, fine workmanship and extreme reliability.

Leaflets free on request.

NEW **Pelapone** ENGINE Co LTD

45, BAKER ST., LONDON, W.1.

'PHONE WELBECK 2519. TELEGRAMS "NEWPELA".
WORKS - LOFTHOUSE GATE, WAKEFIELD.

R.V

Motor Pumps

P.B.2. Type

Specially designed for Country Houses, Garages, Hotels.

Type P.B.2 will lift 250 gallons at 80 ft. or 400 gallons at 35 feet. Consumption 300 watts.

Type P.M.3 will lift 900 gallons at 70 feet, or 400 gallons at 135 feet. Consumption 500 watts.

Thousands used in Country Houses for the supply of water.

Connected with an R.V. Automatic Switch the Pump requires no attendance.

Cheap to run, cheap to fix, as it requires no special installation.

René Volet, Ltd.

242, GOSWELL ROAD,
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'Phone : Clerkenwell 7527.

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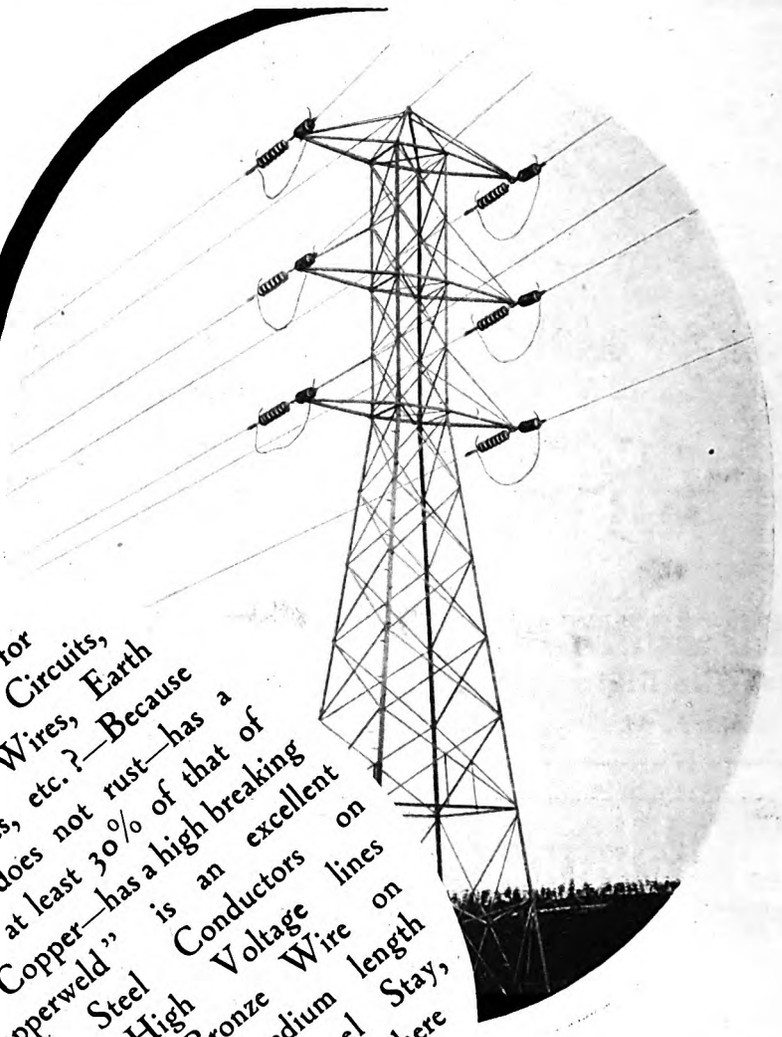
"COPPERWELD"



For Earth Wires

Why use "Copperweld" for your Telephone Circuits, Overhead Earth Wires, Earth Rods, Stay Wires, etc.?—Because "Copperweld" does not rust—has a conductivity of at least 30% of that of Hard Drawn Copper—has a high breaking load. "Copperweld" is an excellent substitute for Steel Conductors on lightly loaded High Voltage lines —for Copper or Bronze Wire on Telephone Lines of medium length —for Galvanised Steel Stay, Catenary and Span Wires where rusting is prevalent, as in Coastal or Industrial Districts.

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CABLE MAKERS AND ELECTRICAL ENGINEERS

PRESCOT, Lancs.

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HELSBY CABLES

C. & A. Modes

The illustration shews the wonderful new building of C. & A. Modes, Ltd., recently opened in Sauchiehall Street, Glasgow. The building is easily the largest of its kind in Glasgow, there being nearly 16,000 square feet devoted to showroom space. The installation of electricity in this establishment is in accordance with the most modern ideas—a thousand electric lights illuminate the windows alone. The electrical installation has been carried out by Messrs. Charters of Glasgow. The whole of the cables used throughout the building are of B.I. manufacture—the most reliable of all cables for the wiring of all classes of buildings — the quality cables.

BRITISH INSULATED CABLES LTD

CABLE MAKERS AND ELECTRICAL ENGINEERS

PRESCOT, Lancs.

London Office :—Surrey House, Embankment, W.C.2.

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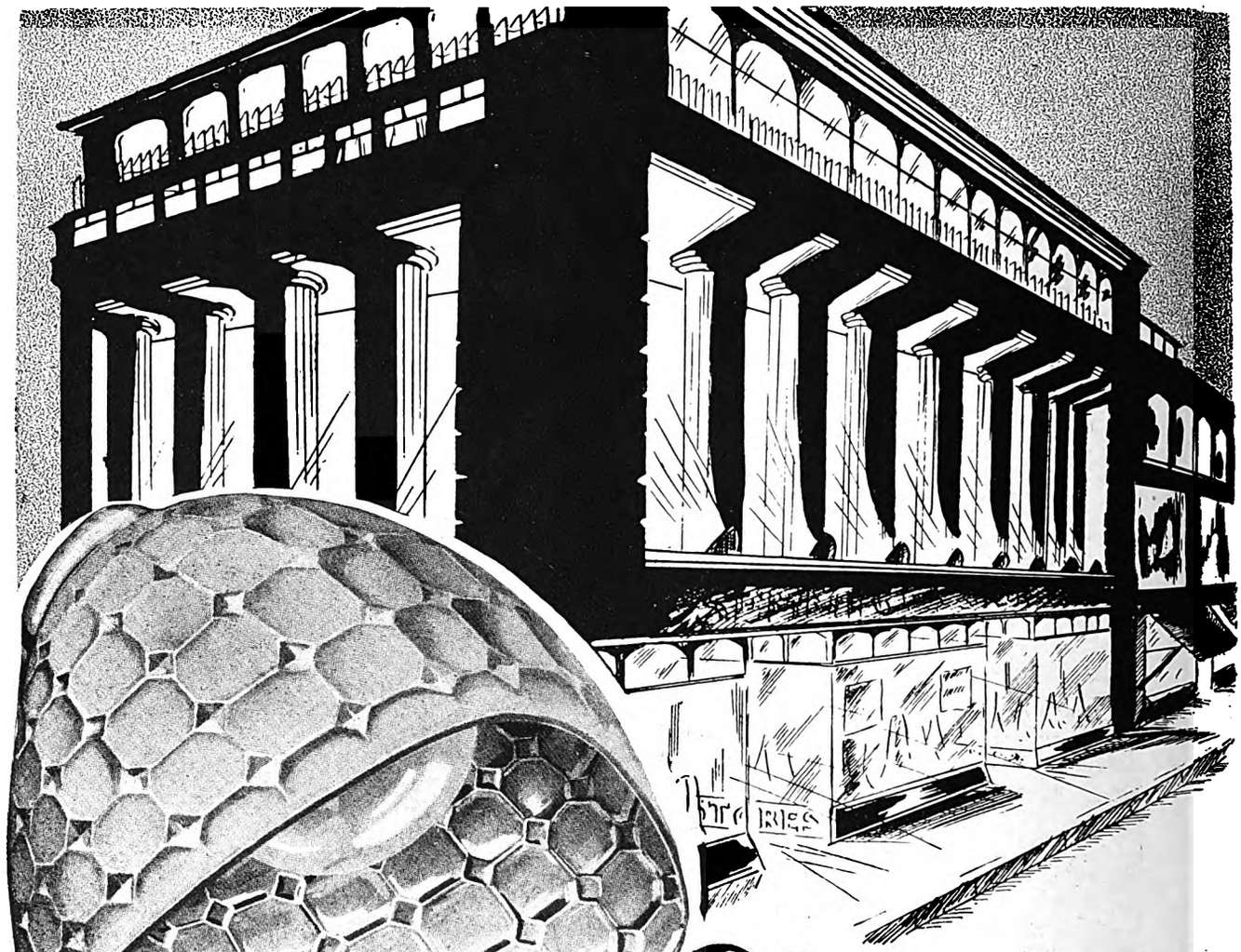

Stores that are Brightest!

THE public like to shop at the store where they can view the goods under ideal and efficient lighting conditions. Those storekeepers who always manage to get the crowds USE QUICKFIX GUARANTEED CHROMIUM REFLECTORS in all their windows because the Quickfix, besides being a beautiful model, focusses the light directly on the goods. This reflector does not peel like inferior makes and is GUARANTEED for SEVEN YEARS. It is coated with several coats of Chromium, Silver and Copper and is subject to efficiency tests before leaving the factories. EVERY QUICKFIX REFLECTOR is a HIGH CLASS PRODUCT. Specify—

QUICKFIX CHROMIUM REFLECTORS

ATTRACTIVE PRICES :

Angle Type :

6½ in. dia., 2¼ in. lip suitable for 60 watt lamps **10/6** *subject.*
8 in. dia. 2¼ in lip suitable for 60 to 100 watt lamps **14/-** *sub.*
9½ in. dia. 3¼ in. lip suitable for 150 to 200 watt lamps **18/-** *sub.*

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Other Sphinx Products :—
Quickfix Lamplocs
Ramie Connectors
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SPHINX

Other Sphinx Products :—
Sphinx Adjustable Bracket & Gallery
Quickfix Vertical Reflectors
Sphinx House-Lighting Lamps
Quickfix Lighting Units

ELECTRIC LIMITED
SPHINX HOUSE, HATTON GARDEN, LONDON, E.C.1.

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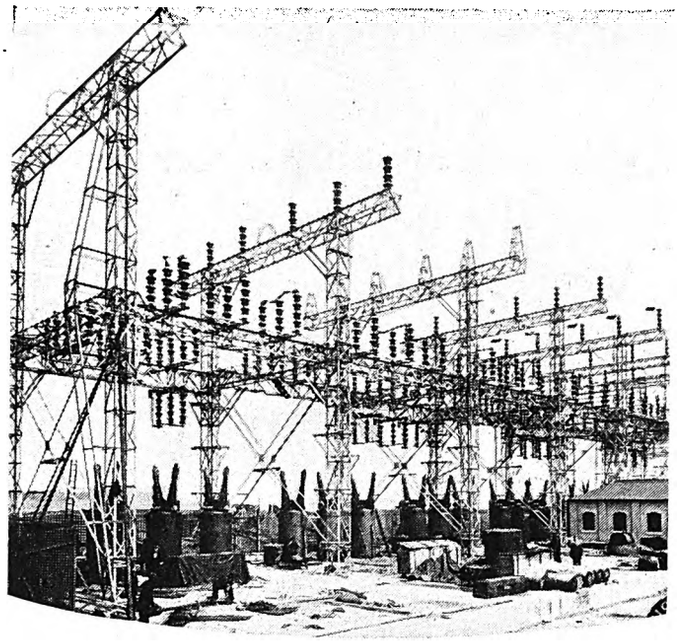


OUTDOOR SUBSTATION EQUIPMENT from the largest to the smallest capacities.

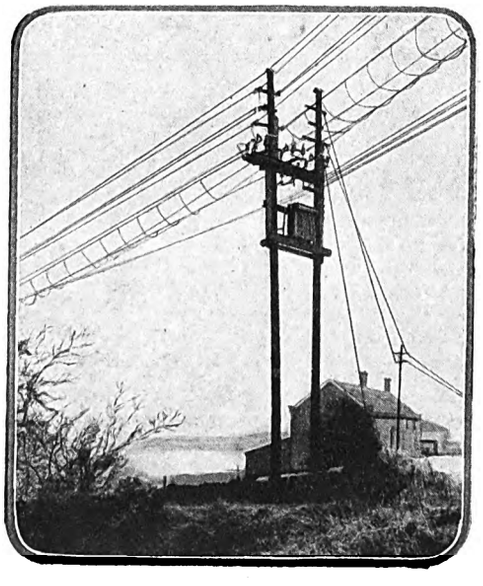
Above:

A 120,000-kVA 132,000/20,000-volt "Grid" Sub-Station at Dalmarnock, Glasgow, with "Metrovick" E.H.T. Transformers and Switchgear.

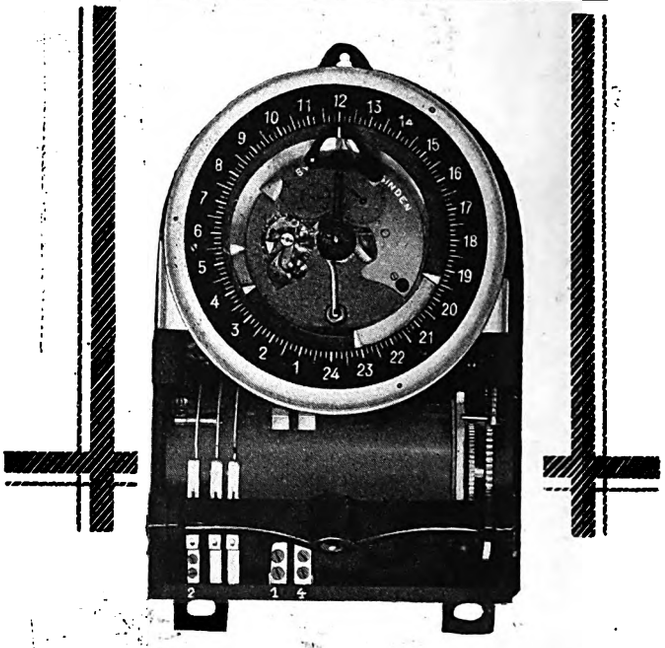
Below:

A 10-kVA Metrovick 2,000/400-volt Farm Line Sub-Station with pole mounted Transformer and Switchgear at Honley, Yorks.

METROPOLITAN Vickers
ELECTRICAL CO. LTD.
TRAFFORD PARK, MANCHESTER.



SADIA
SELF WINDING
TIME SWITCHES



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PUBLIC LIGHTING
SHOP WINDOW LIGHTING
MULTIPLE TARIFFS
CHANGE OVER
GROUP SWITCHING

for use with

ALTERNATING CURRENT ONLY

The time-keeping is guaranteed within one minute per week. This is due to the fact that the clock is automatically wound up at every switching operation, the main spring always exerting the same pressure on the escapement.

All "Sadia" Time Switches are enclosed in strong cast iron hinged cases which are absolutely weather-proof. Provision for sealing is made. Send us your switching problems; we can often save you money by combining switches.

Supreme for Precision Quality and Reliability

SADIA LIMITED, 22, Newman Street, Oxford Street, London, W.1.

'Phone: Museum 0767. *'Grams: Switchauto Wesdo, London.*

Agents for Scotland—Central Electric Co., 45, Hope Street, Glasgow.

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EQUIPOTENTIAL SHEATH TYPE HIGH VOLTAGE CABLE.

THE illustration shows a sample of .1 sq. in. three core H-type 22,000-volt Cable as manufactured, laid and jointed on an order which we recently executed in a London Borough.

* * *

We are prepared to supply three core Cable to work at any voltage up to and including 66,000 volts 3 phase.

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HIGH VOLTAGE CABLE

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Branches :

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A storage battery—whether it be in a central power station or a riverside bungalow — represents a potential working either for or against your business. A good battery—a Pritchett and Gold and E.P.S. Battery, for instance—works positively in your favour. It adds to your prestige and the growth of your business.

"P. & G. and E.P.S." Batteries have been building goodwill for 50 years. They are made as batteries ought to be made. By practical men who know their business. It will pay you to install "P. & G. and E.P.S." accumulators.

Full details, prices, specifications and any help you would like from our technical consulting staff are all at your free call.

PRITCHETT & GOLD AND E.P.S ACCUMULATORS

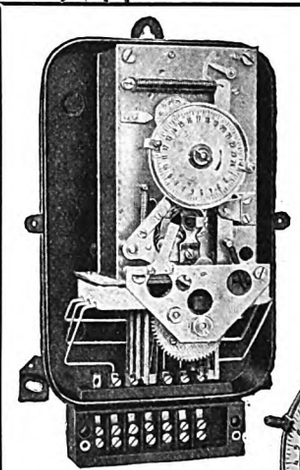
PRITCHETT & GOLD and E.P.S. CO., Ltd.
(incorporating Peto & Radford).
50, Grosvenor Gardens, London, S.W.1.
Telephone: Sloane 7164.
Works: DAGENHAM DOCK, ESSEX.
Glasgow Office:
45, Clyde Place, Glasgow.
'Phone: South 1246

S.B.9.

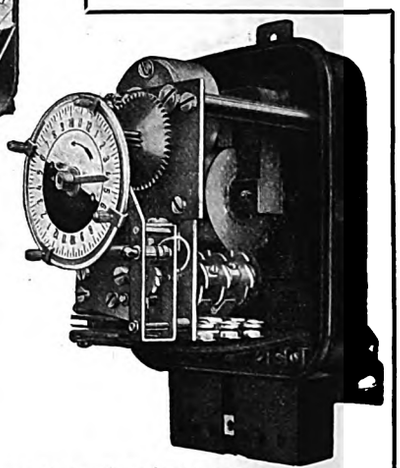
A·E·G

AUTOMATIC TIME SWITCHES

FOR STREET OR WINDOW LIGHTING, METER OPERATION, AND SIMILAR PURPOSES.



15-AMP., 35-DAY,
3-Pole £4 17 6



10-AMP. ELECTRICALLY DRIVEN.
3-Pole £2 16 0.
Fitted with synchronous motor.

Robust Construction.
Reliable Contacts.
Magnetic Spark Quenching.
First-class Clockwork.
Electrically Wound Time Switches for A.C. and D.C.
The most economical, reliable and accurate time switch for A.C. is our SYNCHRONOUS MOTOR DRIVEN TYPE.
No winding. No Adjustment.
2·5 Watt Consumption.
No delicate movement.

Full details on application to

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131, VICTORIA STREET, LONDON, S.W.1

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Telegrams { *INLAND:* "AEGMACHAPP, SOWEST, LONDON."
FOREIGN "AEGMACHAPP, LONDON."

And at

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NOTTINGHAM - Tel. No. 3914
MANCHESTER - Tel. No. Blackfriars 7706 CARDIFF - Tel. No. 1025

A.E.G. REPRESENTATIVES:

A.E.G. India Electric Co., Ltd., Sprott Road, Bombay. Dalhousie Square, Calcutta.

A.E.G. Engineering Co. (S.A.) (Proprietary), 84, Marshall Street, Johannesburg.

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A Meter designed for the

ACCURACY AND PERMANENCE

NECESSARY FOR MODERN SERVICE

Standard sizes :—
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25 „
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100 „

Cast Iron Frame
Glass, Steel, or Aluminium Covers
5 Dial Trains

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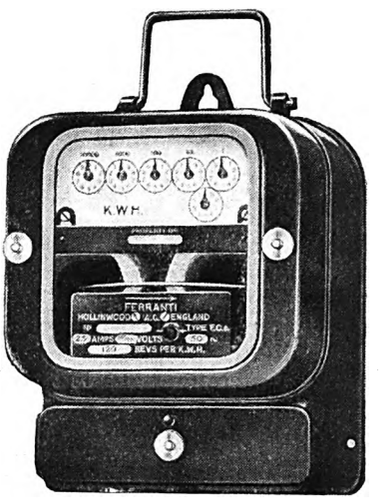

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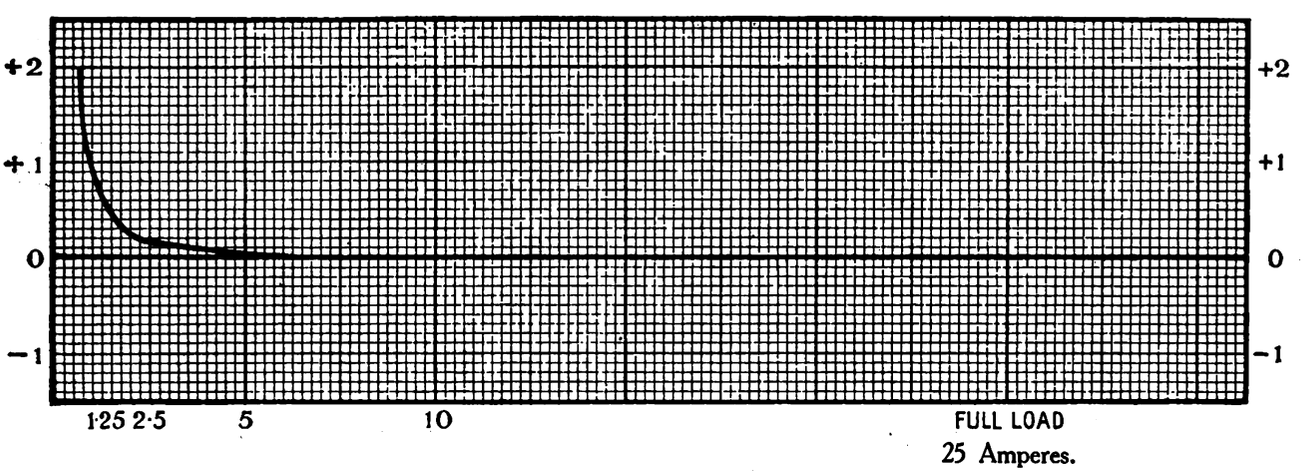

Torque	5.2 gm. cms.	
÷Rotor Weight	26 gm.	=0·0167
÷Speed	**12 r.p.m.**	

In a meter the main technical electrical features are the **Driving** System and the **Braking** System This involves three separate considerations :—

(1) DRIVING ELECTRO-MAGNET
(2) BRAKING PERMANENT MAGNETS
(3) THE ROTOR

The correct general merit factor is :—

$$\frac{\text{Torque}}{\text{Weight of Rotor} \times \text{Speed}}$$

FERRANTI LTD. - - Hollinwood - - Lancashire

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SHEETS—RODS, TUBES.

MOULDINGS.

United Ebonite Manufacturers, Ltd.,

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Anti-Vibration, Permanent Security (Patent No. 300,042.)

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THE EARTHING CLIP CO.

71, Hatherley Street, LIVERPOOL.

MAKERS of all kinds of ordinary and ADJUSTABLE EARTHING CLIPS. SEND FOR PRICE LIST.

ARTIFICIAL SILK YARNS

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(GENUINE AMERICAN.)

SHEETS, RODS, TUBES, BUSHES, DISCS, WASHERS.

SEND YOUR ENQUIRIES FOR ABOVE TO

AUSTIN & HAYES, WOODSIDE WORKS HIGHGATE, LONDON, N.

"Austayes, Higate, London." Telephone: Mountview 1476.

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IMPULSE and REACTION TYPE.

SENSITIVE BRITISH MADE GOVERNORS.

GILBERT GILKES & GORDON, Ltd.,

KENDAL, ENGLAND.

Complete Set with full instructions. Price **7/6**

The Lamp alone, **2/6**

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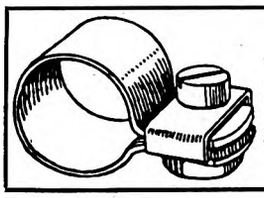

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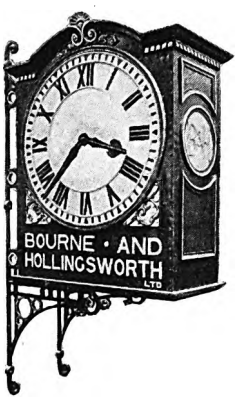

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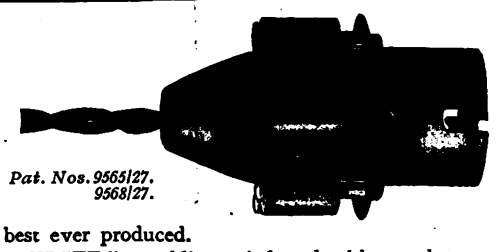

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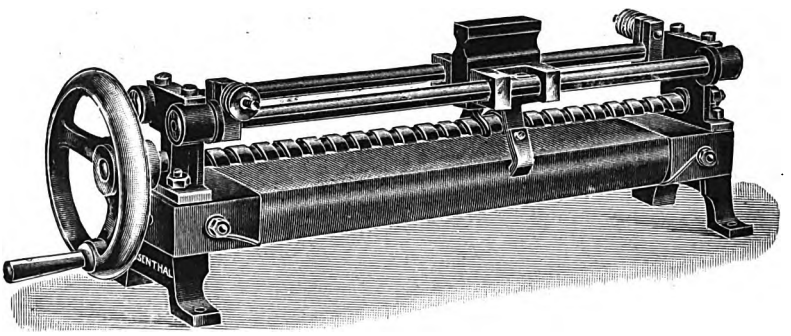

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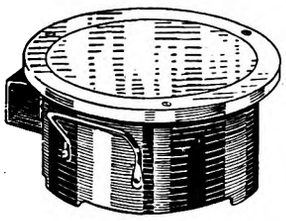

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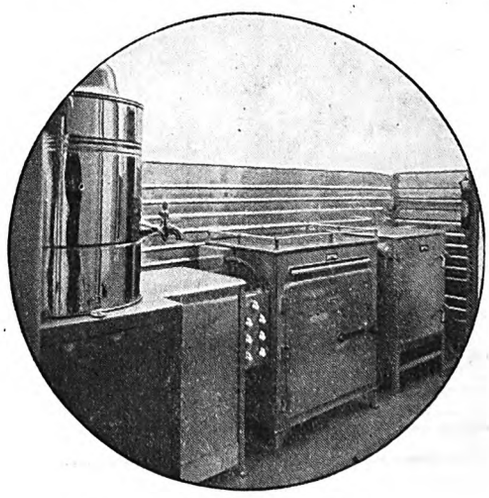

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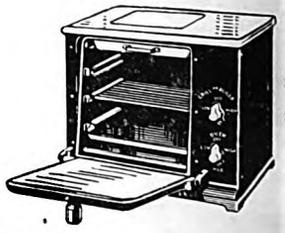

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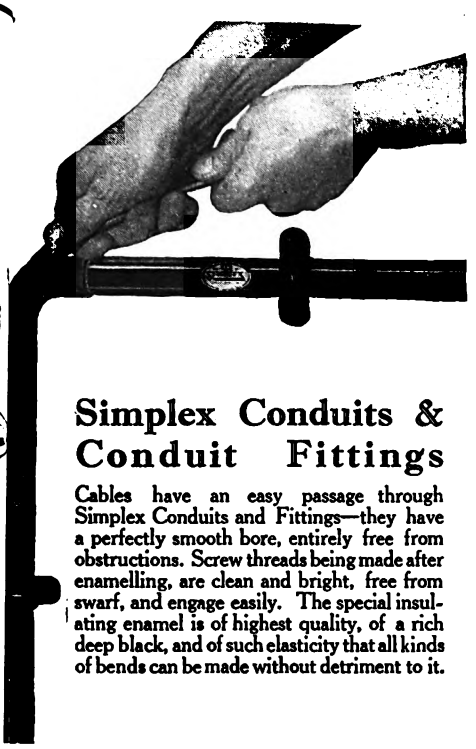
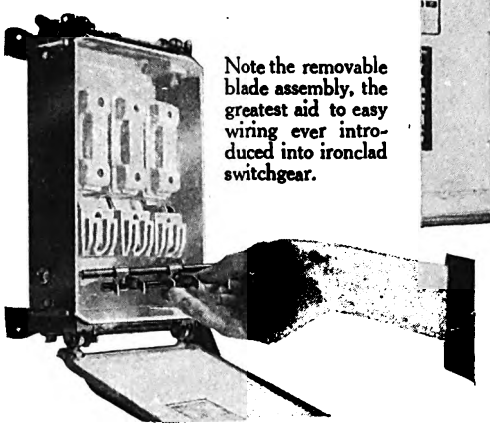


Simplex Standard Switch & Fuse Gear



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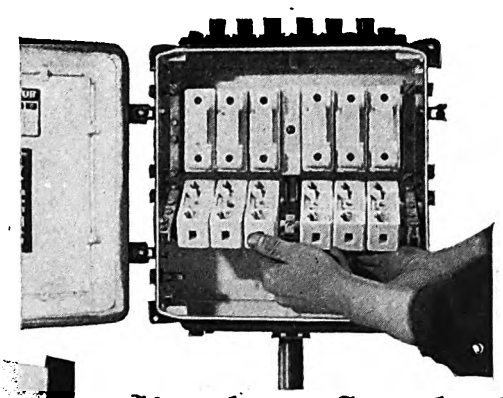

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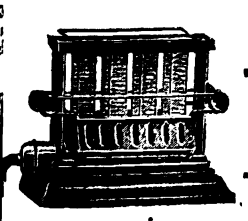

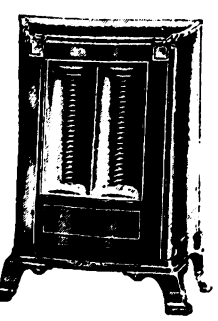

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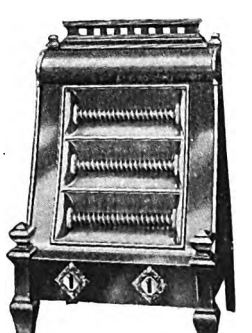

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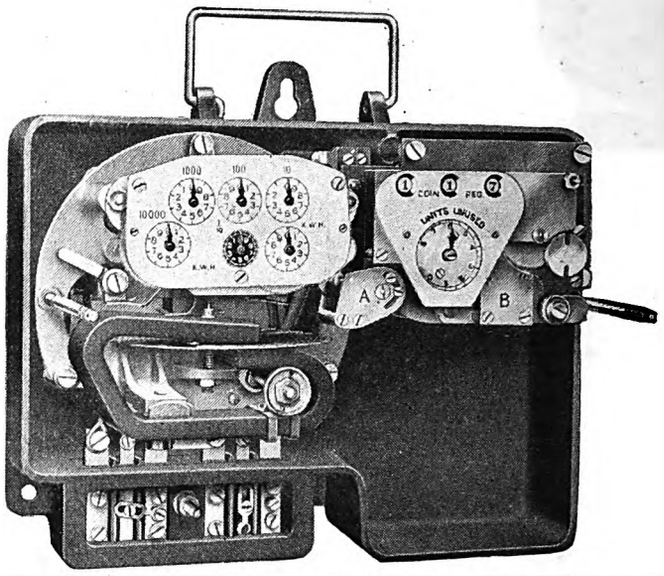
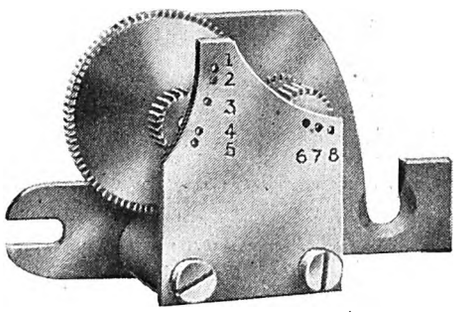
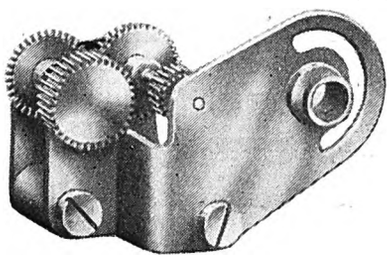
Prepayment Price Change Simplified





Easy price change gear



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The prepayment mechanism is extremely easy to understand so that repairs and replacements are simplified

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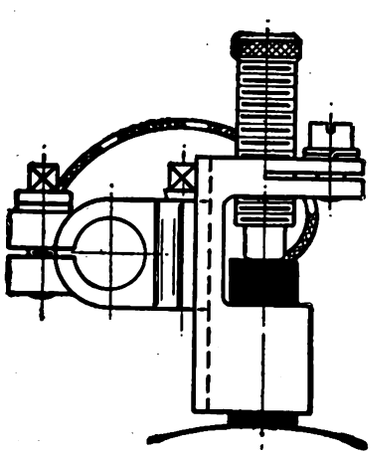

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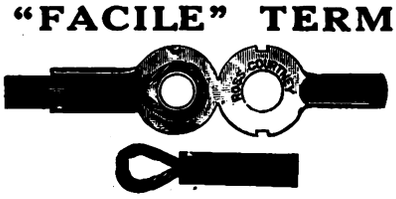

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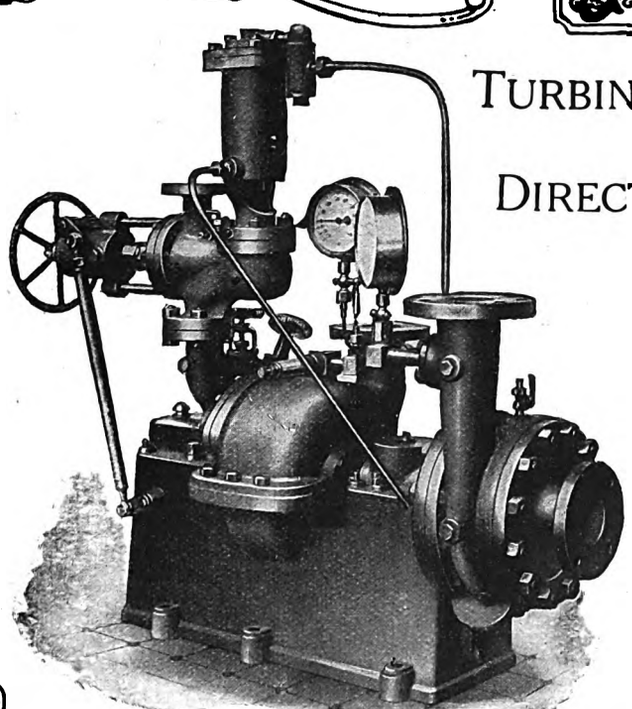

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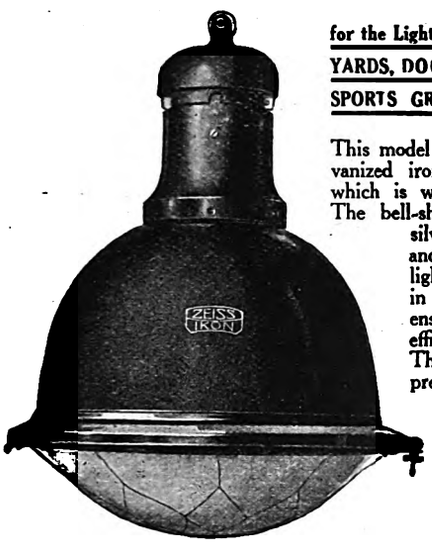

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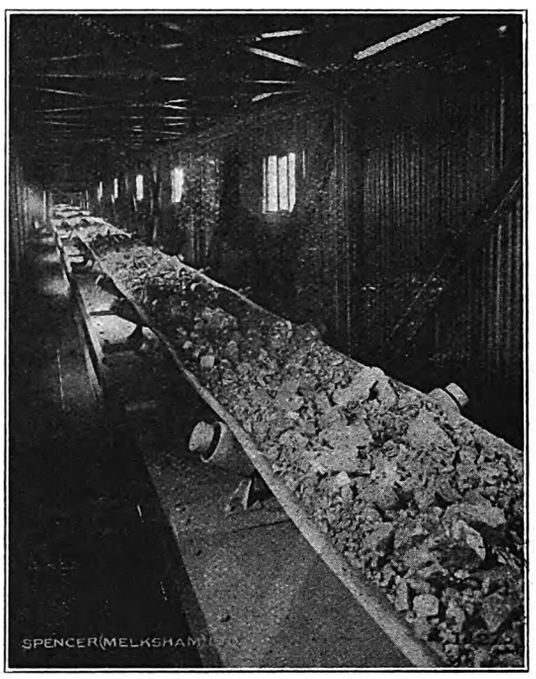

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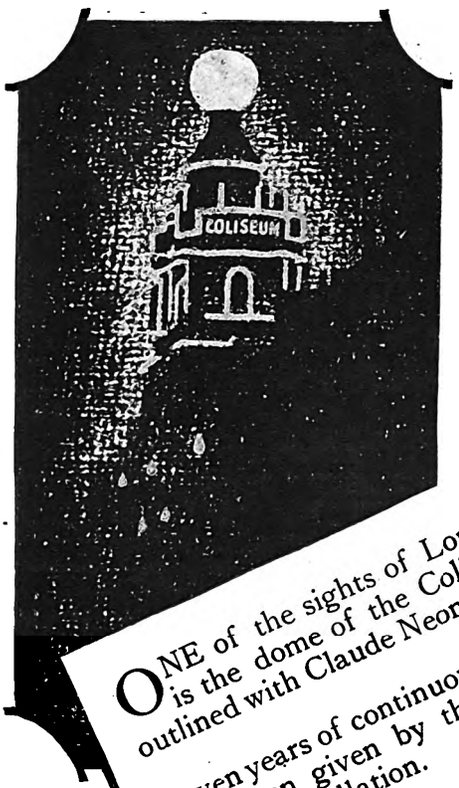

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IN THE FACTORY OR WORKSHOP!

THE Cyclone Heater Unit introduces a new principle of heating—an extremely effective and economical system easy to instal.

Bolted to a wall or column at any suitable height, the Unit throws warm air down towards the floor at any preferred angle, thus distributing its heat with some degree of ventilation.

For extensions to workshops and for temporary premises, the Unit is particularly efficacious.

The advantages over the ordinary radiator are obvious.

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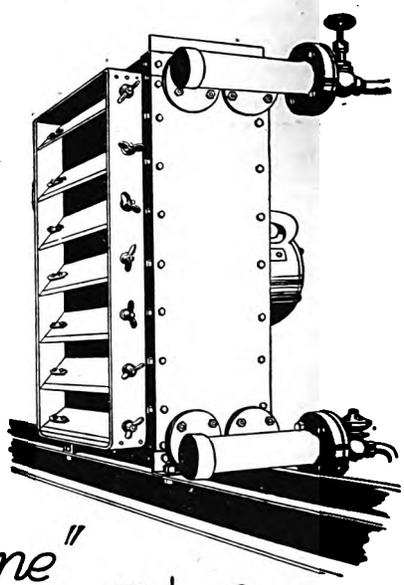
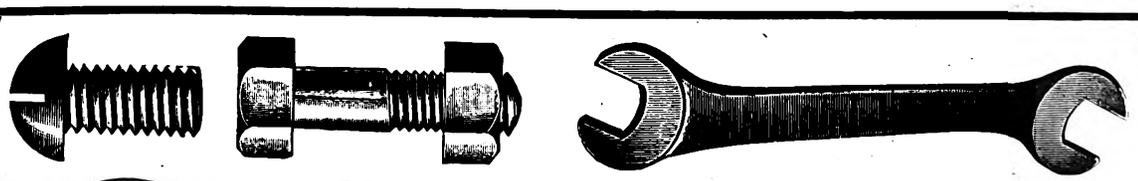


The "Cyclone" Heater Unit

MATTHEWS & YATES, Ltd., Swinton, MANCHESTER.



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WHITTALL STREET,
BIRMINGHAM.

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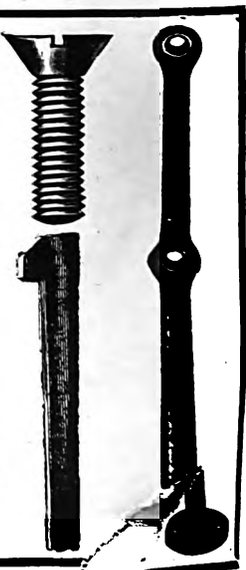

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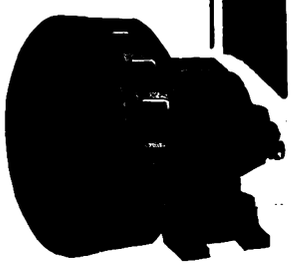
Electro Motor SYRENS



1/10 H.P SYREN.

Tangent Electro-Motor Syrens are necessary to every modern Industrial concern.

The 1/10 Horse-Power Model is specially designed to supply a long-felt want as an indoor Sound Signal, being easily heard in the noisiest workshop.

For Service Mains, A.C. or D.C., up to 250 volts.

We also manufacture other larger models for general and outdoor use, ranging from 3/16 to 8 horse-power.

Write for Illustrated Leaflet free on request.

TANGENT Sound Signals include A.C. & D.C. Power Bells, Wood-Cased Bells, Buzzers, Etc.

TANGENT GENT & Co. LTD. Established 1872

Faraday Works, LEICESTER.

LONDON: 25, Victoria St., S.W.1.

NEWCASTLE-ON-TYNE: Tangent House, Blackett St.

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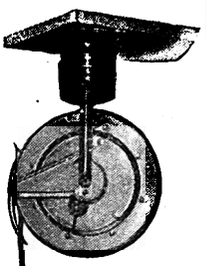
LITTLE GIANT
Portable Electric Drills.

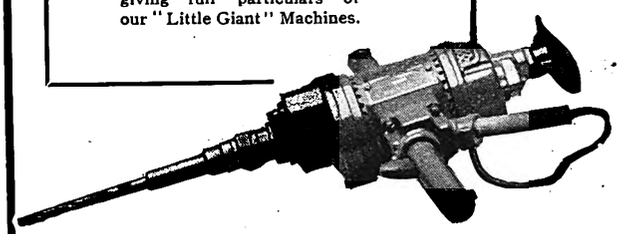


DRILLING metal or wood with Little Giant Portable Electric Drills is easy labour and increased production results from their use because they are fast, always fit, and have the all-essential staying power.

OUTSTANDING FEATURES

Ease of Manipulation.
Conveniently placed Trigger Switch.
Light Weight.
High Drilling Speed.
Ball Bearings throughout.
Air-Cooled Motor.

Write for Catalogue No. 15, giving full particulars of our "Little Giant" Machines.



Drill fitted to Cable Reel, which automatically takes up the slack of the cable.

The Consolidated Pneumatic Tool Co., Limited,
Egyptian House, Piccadilly, London, W.1.
Main Works: Fraserburgh, Scotland.
Branches all over the world.

Two Connector Boxes in One!

No punishing of Conductors by sharp bends. A place for everything and everything in its place. A neat box with a large capacity.

Universal One-to-Four Way.

Each Way takes up to 3-Twin 3.029 Cables. Size only 3½ ins.
Clamps removable, allowing Cable to be laid in flat.

NO LOOSE SCREWS. NO CUTTING TOOLS.
Easy and speedy to connect up.

Specially designed for India and the East, where a large number of Lights and Fan Circuits are taken from one service. WRITE FOR LIST M.W.

Telephone Central 1090 & 1091 (2 lines).

Telegrams: "Voltaic, Manchester,"

J. C. WHITE & Co., Ltd.

(Specialists in Shock and Corrosion-proof Lighting Accessories).

49, BRIDGE STREET, DEANSGATE, MANCHESTER.

GLASGOW—74, York Street, C.1. *Telephone: Central 6393.*
BATTERIES—Fountain Place Buildings Liverpool Road BURSLEM

"ZAPON" ENAMEL
for all electrical fittings

Everyday use under most severe conditions is the regular lot of electrical equipment these days.

The life of an attractive finish depends on the lacquer with which it is protected and Crane's "Zapon" has been proved by large manufacturers throughout the country to give their work the best possible protection under present day conditions.

Send this coupon to obtain a sample for testing.

FREDK. CRANE CHEMICAL CO., LTD.
Armoury Close, Bordesley Green, BIRMINGHAM.

Telephone: Victoria 0416, 0417 and 0418. Wires: "Chemical Birmingham."

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LONDON: F. Lett & Co., 25 Great Sutton Street, E.C.1.
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For further particulars and list of Crane Products, write or send this coupon to the above address.

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Electrical Review.

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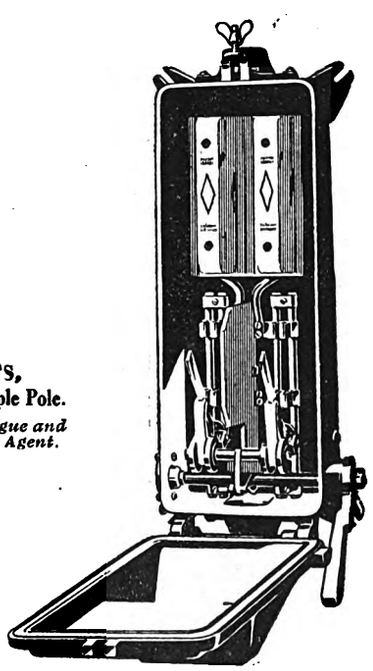
IS AS GOOD AS ANY —— and better than many

"VINCENT"
IRONCLAD COMBINED SWITCH FUSE

clearly leads its class in continuous efficiency under heavy-duty service.

Robust quality in the switch movement is supplemented by the unequalled VINCENT Patent Fuse Elements.

The substantial housing is lined with silicate enamel, and the mounting is in accordance with the latest practice.



600 VOLTS,
Double Pole & Triple Pole.
Write for Catalogue and Name of nearest Agent.

VINCENT
Switchgear Manfg. Co., Ltd.,
SAMPSON ROAD NORTH
BIRMINGHAM.

SWITCH AND FUSEGEAR *ONLY*

W.H.W.

CONDENSING PLANT AUXILIARIES

STEAM AIR EJECTORS
2 or 3 Stage with Intercoolers in 1 Casing. We were the **first** firm to introduce Multi-Stage Air Ejectors into Great Britain, thereby revolutionizing Condensing Plant Development—**first then and first now.**

"HIVAC"
EXTRACTION PUMPS
Single and 2 Stage, with Pressure Sealed Glands.

FEED WATER HEATERS
High and Low Pressure.

EVAPORATORS

COMPLETE CLOSED FEED SYSTEMS

DE-AERATORS

SELF-CLEANING CIRCULATING WATER-STRAINERS

HICK HARGREAVES & CO. LTD. BOLTON

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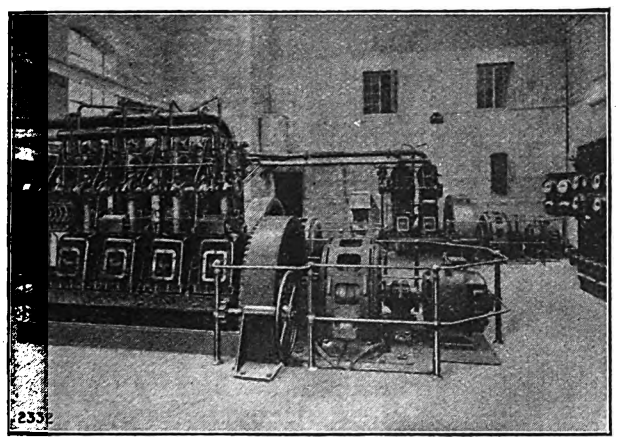
Newry U.D.C.
instal
Paxman
Oil Engines



Paxman Oil Engines direct coupled to G.E.C. Alternators installed at Newry U.D.C. Electricity Supply Station.

Other installations include—

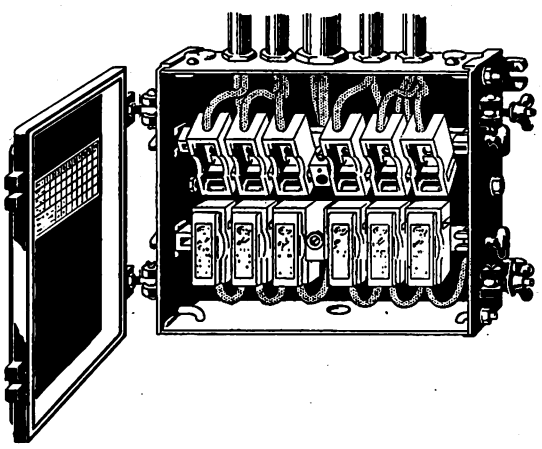
a 1,070 B.H.P. Engine for the Ashford U.D.C., and a further order for a 1,500 B.H.P. Engine.

The ELECTRICAL ENGINEER at ASHFORD in a recent letter states:—

> *"On looking over our generating costs for the year ending last March, I find that the cost of fuel per unit is '2705d. against '345d. of the previous year. This is satisfactory, and though a good deal of the saving is due to increased output, there is no doubt that some of it is due to the performance of your engine."*

Electrical Engineers interested in the economical production of Power and Light should write for publication No. H952 to:

Davey, Paxman & Co., Ltd.
(Associated firm of Agricultural & General Engineers, Ltd.)
53-56, Aldwych House, Aldwych, London, W.C.2
Telephones: Holborn 4966-7 *Works: Colchester.*



Ready for IMMEDIATE USE.

This 10/15-amp. Ironclad Fuseboard can be handed direct to the wireman.

It is only necessary to knock out the steel discs when conduit or glands for special cables can be fixed immediately for any installation. There is no need to wait for drilling—erection costs and delay are saved.

Fitted with Home Office type fuses, and of M.E.M. standard of quality throughout.

M.E.M. Gear saves time and money and gives greater security at no greater cost.

SEND FOR LIST No. 175

KANTARK
Ironclad Fuseboards.

MIDLAND ELECTRIC
Manufacturing Co, Limited.
BARFORD ST. BIRMINGHAM
M E M
SPECIALISTS IN IRONCLAD SWITCH & FUSE GEAR

Also at

LONDON, MANCHESTER, GLASGOW, NEWCASTLE, LEEDS, BRISTOL, BELFAST, DUBLIN, SYDNEY, BOMBAY, JOHANNESBURG, SHANGHAI, and BUENOS AIRES.

AND ALL ELECTRICAL WHOLESALERS.

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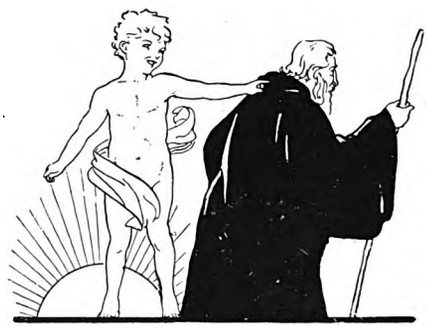

BEST WISHES FOR 1930 . . .

THE ever-recurring promise of the New Year coincides this time with the certainty that 1930 will be a year of Prosperity for the whole Electrical Industry.

Big undertakings are nearing completion, others are in perspective. Both the one and the other are a virtual guarantee that the 1929 demand for electrical material will be greatly exceeded in 1930.

To our many Trade Friends we extend the compliments of the season, together with our congratulations on the excellent volume of business done in 1929.

In 1930—as in all years since 1898,—the SUNCO will be doing its part and to those who do not know what SUNCO SERVICE means we can think of no better wish than that they should have ample opportunity of experiencing its benefits in the opening year.

. . CONGRATULATIONS ON 1929

THE SUN ELECTRICAL Co. LTD.

Telegrams—
"Secabilis, Westcent, London."
Telephone—
Temple Bar 3500
(10 lines).

118-120, Charing Cross Road,
LONDON———W.C.2.

LEEDS:
49-50, Park Place.
NEWCASTLE-on-TYNE:
112, Pilgrim Street.

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ruminations

The road to Hell is paved with good intentions. You can ensure a smooth passage in whatever direction you are travelling by making a New Year resolution to use VENNER TIME SWITCHES. If you succeed in this they will pave your way to Heaven.

and a wish

TO FRIENDS IN THE TROPICS
A COOL BREEZE TO FAN YOU,
TO THOSE IN COOL CLIMATES
A HOT SUN TO TAN YOU,
IN TEMPERATE PLACES
FAIR WEATHER, NOT DIRTY,
TO FRIENDS EVERYWHERE

good luck 1930

VENNER TIME SWITCHES

Telephone: VICTORIA 2552 Private Exchange.

45, HORSEFERRY ROAD, WESTMINSTER, S.W.1.

Telegrams: "CLOXWICHES Phone, London."

OVERSEAS AGENTS:—

S. Africa.—Hubert Davies & Co., Ltd., Johannesburg, Durban, Capetown, Salisbury, Bulawayo, etc.

New Zealand.—Jas. J. Niven & Co., Ltd., Wellington, Auckland, Christchurch, Dunedin, etc.

Australia.—H. Rowe & Co., Melbourne and Sydney.

STAND 80, BARCELONA EXHIBITION.

Canada.— Lincoln Meter Co., Toronto.

Malay States.— Huttenbach, Lazarus & Sons, Ltd., Penang and Singapore.

Belgium. M. Pierre Pollie, Rue de l'Abendance, Brussels.

Holland.— G.E.C. (Holland) Ltd., The Hague.

Portugal.—M.M. Mussche, Rua Garrett, Lisbon

Spain.—Anglo Espanola de Electricidad, S.A., Barcelona, Madrid and Bilbao.

Norway.—Elektrisk Bureau, Oslo.

Denmark.—M. H. Larsen, Copenhagen.

Argentine.— Anglo-Argentine G.E.C., Ltd., Buenos Aires.

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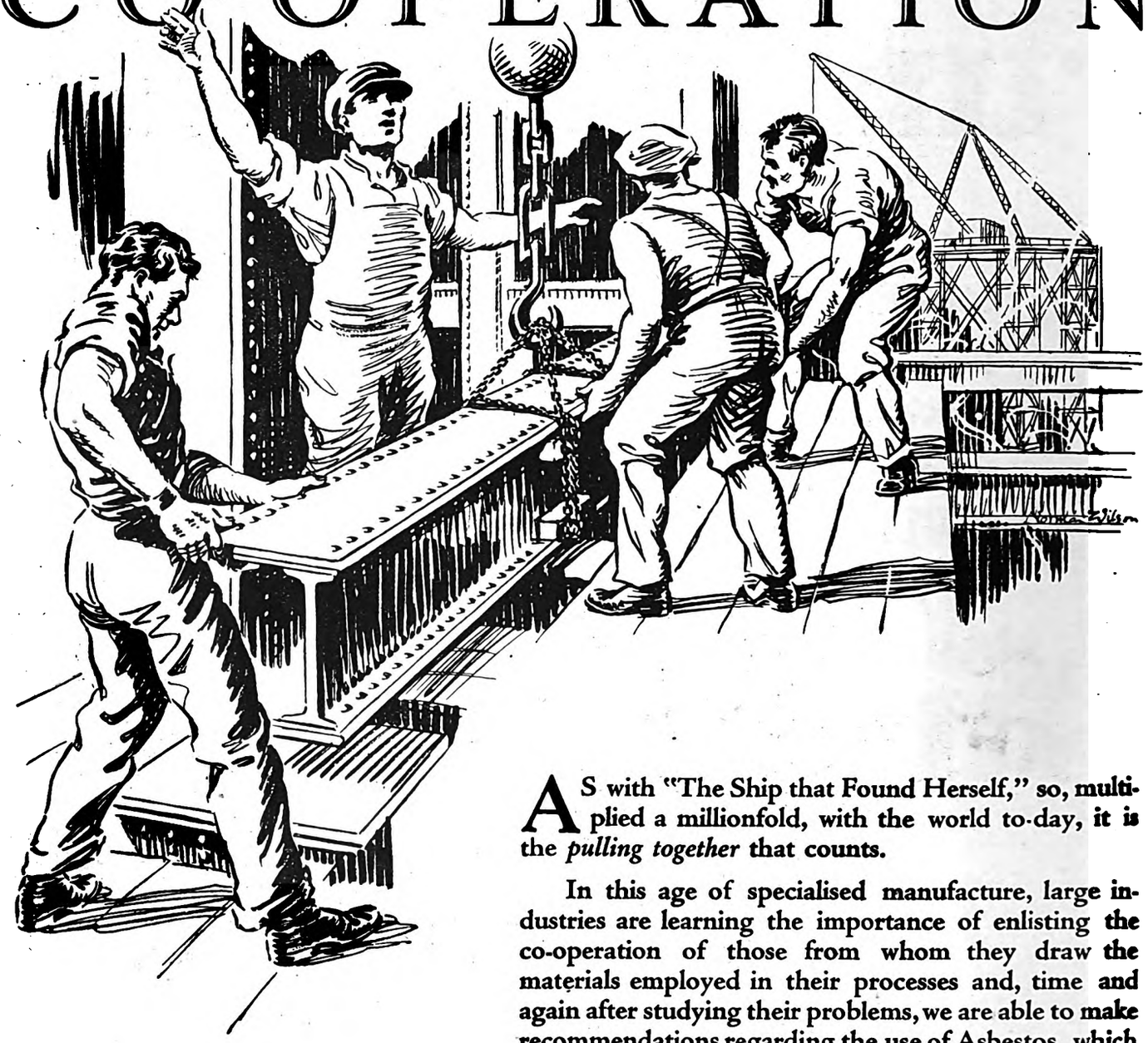
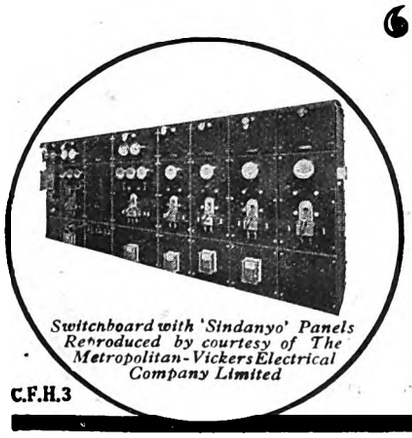
CO-OPERATION



AS with "The Ship that Found Herself," so, multiplied a millionfold, with the world to-day, it is the *pulling together* that counts.

In this age of specialised manufacture, large industries are learning the importance of enlisting the co-operation of those from whom they draw the materials employed in their processes and, time and again after studying their problems, we are able to make recommendations regarding the use of Asbestos which result in far-reaching economies. Is it not possible that our fifty years' experience would be of service to you?

Ebony "Sindanyo" was produced, after seven years' research, as a result of the closest co-operation with some of the largest electrical manufacturers in this country, and the whole Electrical Industry is, to-day, benefiting. Please send us your problems.



Switchboard with 'Sindanyo' Panels Reproduced by courtesy of The Metropolitan-Vickers Electrical Company Limited

C.F.H.3

"SindanyO"

REGISTERED

INSULATING BOARD.

·DIELECTRIC·HOMOGENEOUS·STRONG·

TURNERS ASBESTOS CEMENT LTD.,
TRAFFORD PARK, MANCHESTER.

Please enquire for Brochure No. 13.

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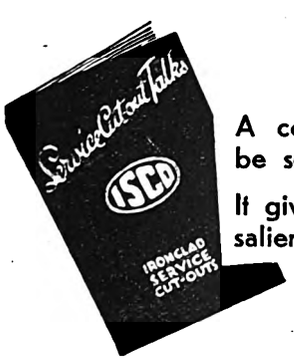
LOOK AT THE FUSE BASE

You can be sure it's an ISCO merely by looking at the fuse base. The simple method of fixing the terminal by means of the patent spring fork gives self-aligning contacts, and also does away with the screw passing through the base from the underside —always a possible source of failure should the compound stopping melt or fall out. There are many little features like that in ISCOS which make an Engineer say, "There's an ISCO!"



A copy of this Booklet will be sent Post Free on request

It gives full details of all the salient features of ISCO Cutouts

Big leads lead to big loads

STANDARDIZE THE 60 AMP. SERVICE

MANUFACTURED BY

W.T.HENLEY'S TELEGRAPH WORKS CO. LTD. HOLBORN VIADUCT. E.C.1

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GLOVER'S "GLO-CLAD" WIRING SYSTEM

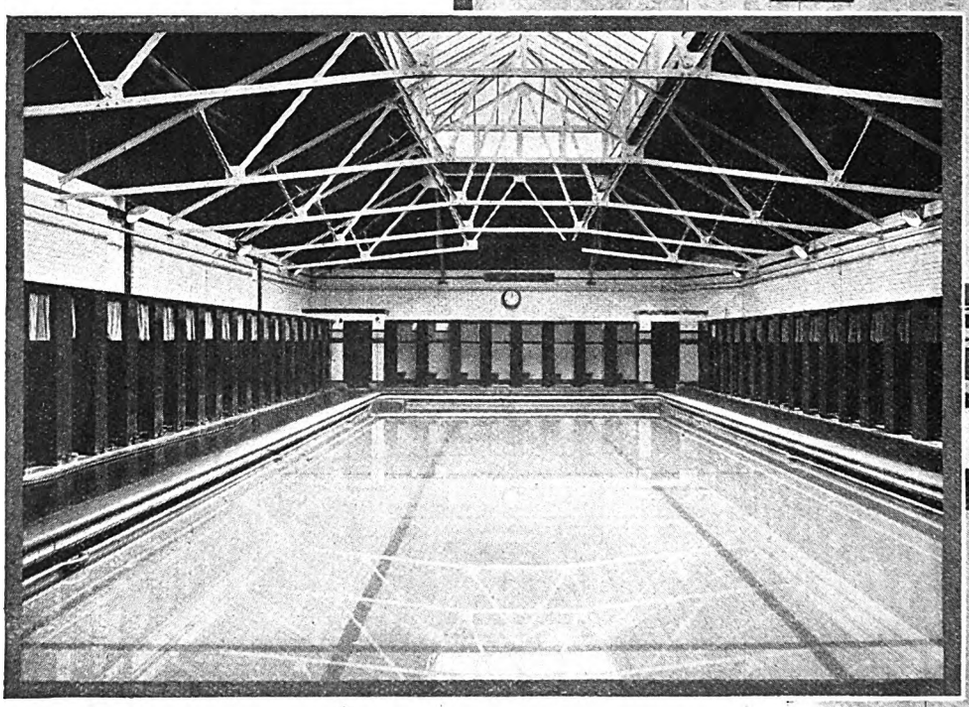
Ideal for Installations in SWIMMING BATHS, LAUNDRIES, BREWERIES, DISTILLERIES, ABATTOIRS, COLD-AIR STORAGES, CHEMICAL WORKS, PAPER MILLS, and all hazardous situations.

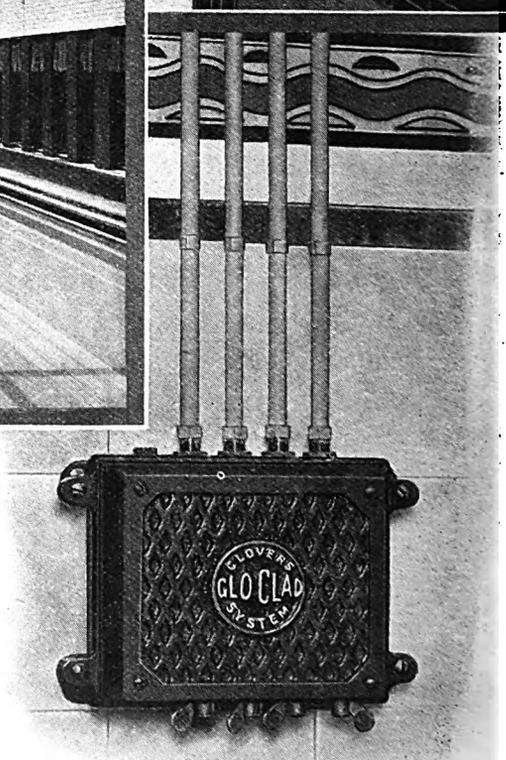
OBVIATES CONDENSATION TROUBLES.

ENSURES PERFECT BONDING.

EASILY INSTALLED.

NEAT APPEARANCE.





CHORLTON-CUM-HARDY BATHS.

A RECENT "GLO-CLAD" INSTALLATION

carried out for

THE MANCHESTER CORPORATION

by

Messrs. MAITLAND & CO. (MANCHESTER), LTD.,

Electrical Engineers,

29, PRINCESS STREET MANCHESTER.

WRITE FOR CATALOGUE No. 22.

W. T. GLOVER & Co., Ltd.,

TRAFFORD PARK - - - MANCHESTER.

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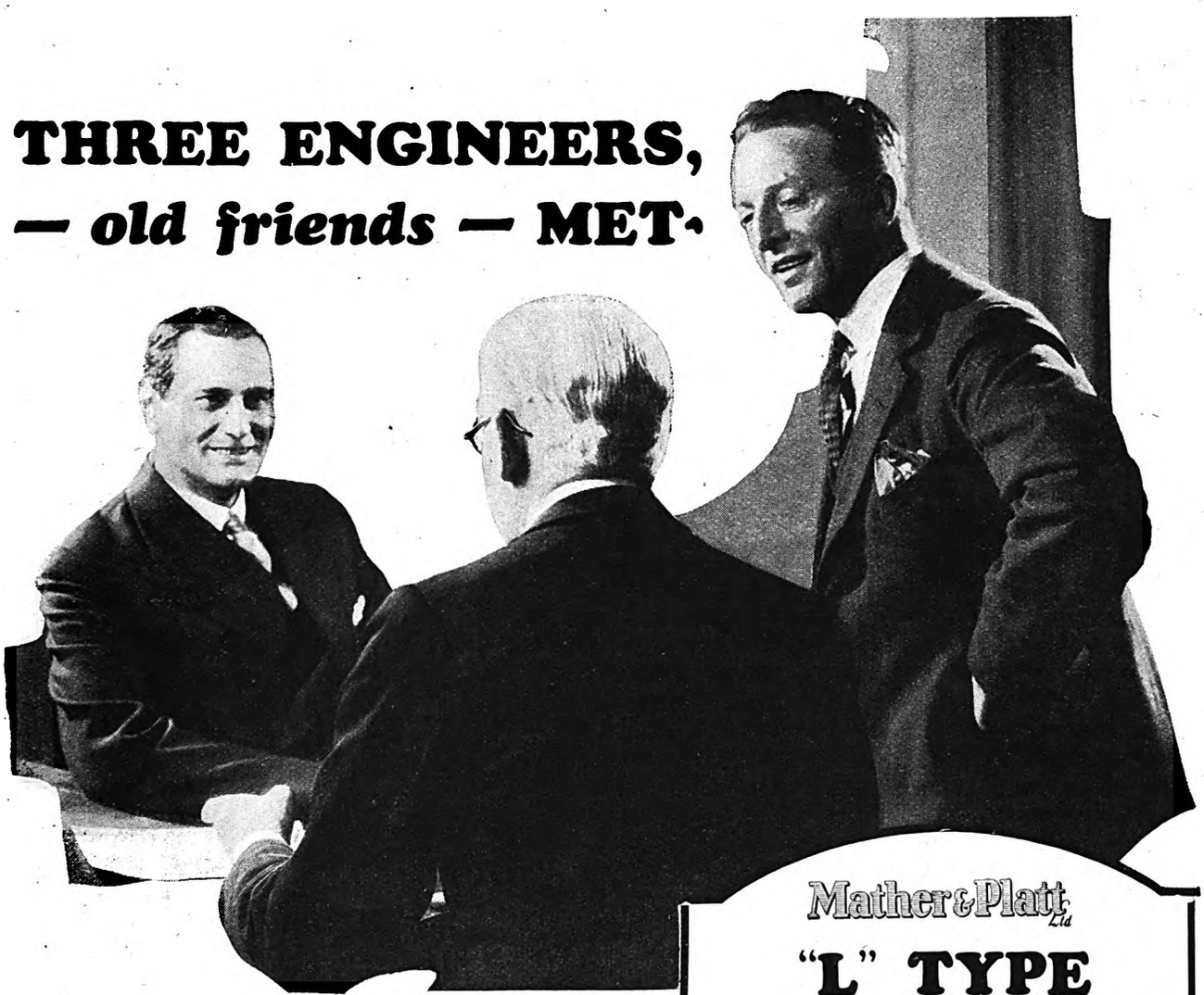
THREE ENGINEERS, — *old friends* — MET.



—and of course conversation turned towards "shop" and electric motors in particular. They knew the good points of a motor and were unanimous in placing Mather & Platt Machines in the forefront.

The first, a colliery man, had never found a motor to stand up so well to the arduous conditions of his work.

The chemical works manager found his production steadier by virtue of fewer breakdowns—a tribute to the sound workmanship in a Mather Motor.

And the other, a consultant, was impressed by the theoretical points of design and winding and by the solid construction of all the vital parts.

If you would care for information about Mather and Platt Electric Motors—either A.C. or D.C. write for booklet E 77a—or leaflets on any special type in which you are interested.

Mather & Platt Ltd

Electrical & Hydraulic Engineers

PARK WORKS, MANCHESTER

and at

Park House, 22, Great Smith Street, London, S.W.1

Mather & Platt Ltd

"L" TYPE

Induction Motors

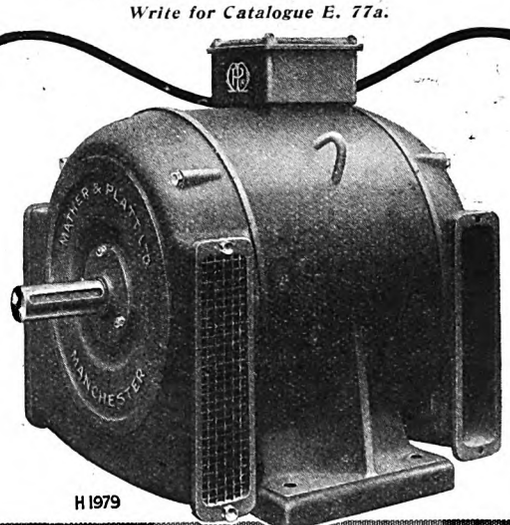
FOR EVERY ELECTRIC DRIVE

Mather & Platt "L" Type Motors are simple, "clean," and robust in design, adaptable to widely varying conditions yet low priced. New resources, improvements in materials and a reorganisation of production methods have made this Motor possible—a better motor at a more advantageous price.

Reliability and electrical efficiency are higher than ever before. All L type motors comply in every respect with British Standard Specification No. 168/1926.

Every "M. & P." motor is tested for 4 to 6 hours under Load—it is the users' safeguard.

Write for Catalogue E. 77a.



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A MOTOR FOR EVERY ELECTRIC DRIVE

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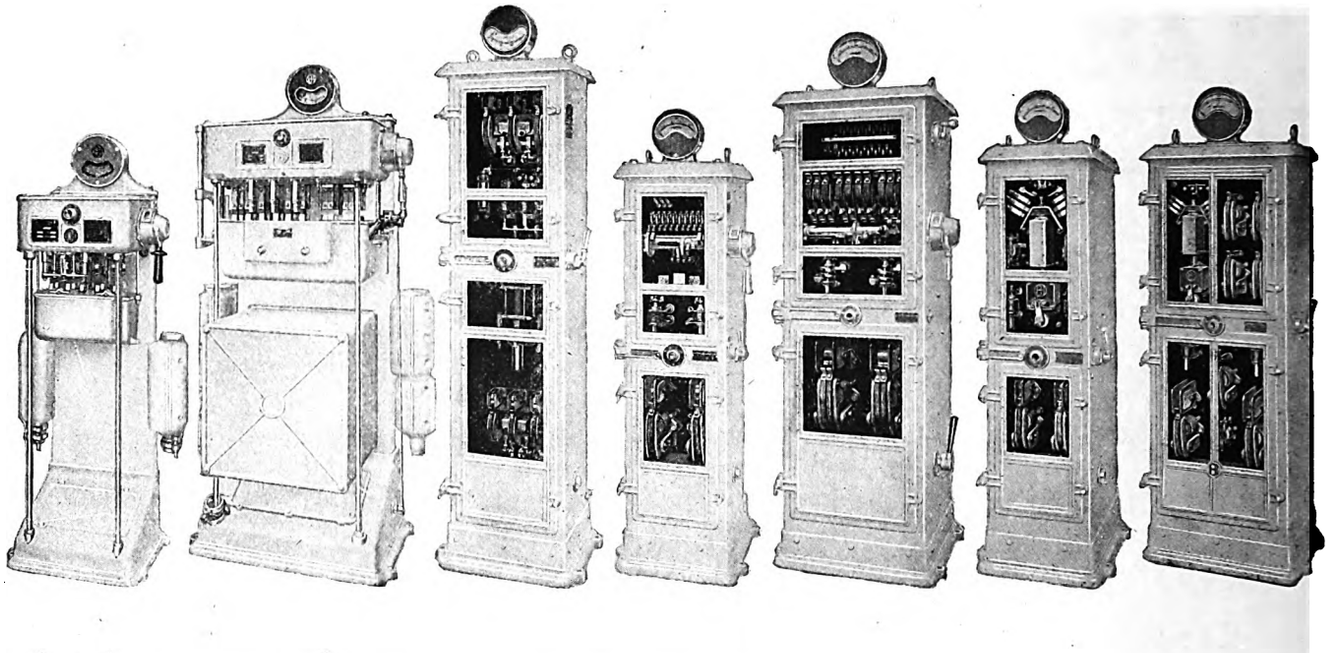

12,500 H.P. in one factory

10,000 H.P. A.C. and another 2,500 H.P. D.C.—12,500 H.P. in all—that is the total horse-power of the motors controlled by "Brookhirst Switchgear" in one artificial silk factory. Some of the types of Motor Control Panel are illustrated above—hand operated Star Delta and Rotor Starters, automatic Rotor Starters, D.C. control panels, hand operated and automatic—the whole galaxy of modern control gear is represented in this factory.

It is not an exception. The largest industrial plants—bearing household names which leap to the mind when chocolate, soap, and steel are mentioned—are usually the most attached to Brookhirst Switchgear. Why? Because they can keep accurate maintenance costs and can prove that good switchgear more than justifies itself. Proof may be more difficult in your case, but the experience of others is worth noting.

Meantime, let us send you any of our technical publications which are of interest.

TO: BROOKHIRST SWITCHGEAR, LTD., CHESTER.

Please send me the Publications marked "X."

No. 7	A.C. Control Gear: oil immersed.
„ 10	A.C. Control Gear: air break.
„ 11	Marine Control Gear.
„ 12	D.C. Control Gear: hand operated.
„ 13	D.C. Control Gear: automatic.
„ 245	Control of Printing Machinery.
„ 247	Control of Voltage & Power Transmission.
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„ 278	Control of Synchronous Motors.
„ 283	Control of Ships' Auxiliaries.
„ 284	Control of Power Factor.
„ 287	Multi-speed A.C. Starters.
„ 291	Control of Woodworking Machinery.
„ 292	Printing Exhibition, 1929.

Signed.....

Firm.....

Address.....

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BROOKHIRST SWITCHGEAR

CHESTER.

SELL US YOUR

Battery Plates & Peroxide

PROMPT SETTLEMENT

Capper Pass & Son Ltd

SMELTERS & REFINERS

BEDMINSTER SMELTING WORKS · BRISTOL

TELEPHONE 8080 (3 LINES) TELEGRAMS "PASS BRISTOL"

BAILEY'S "TELL-TALE"

RECORDERS

FOR PRESSURE AND VACUUM.

Indicate and record Steam, Air, Gas and Water Pressure at any distance from the source of pressure.

Air Compressors, Vacuum Pumps, Lubricators, Valves and Cocks, Boiler Fittings, &c.

ESTABLISHED 1839.

Sir W. H. BAILEY & Co., Ltd.,

MANCHESTER.

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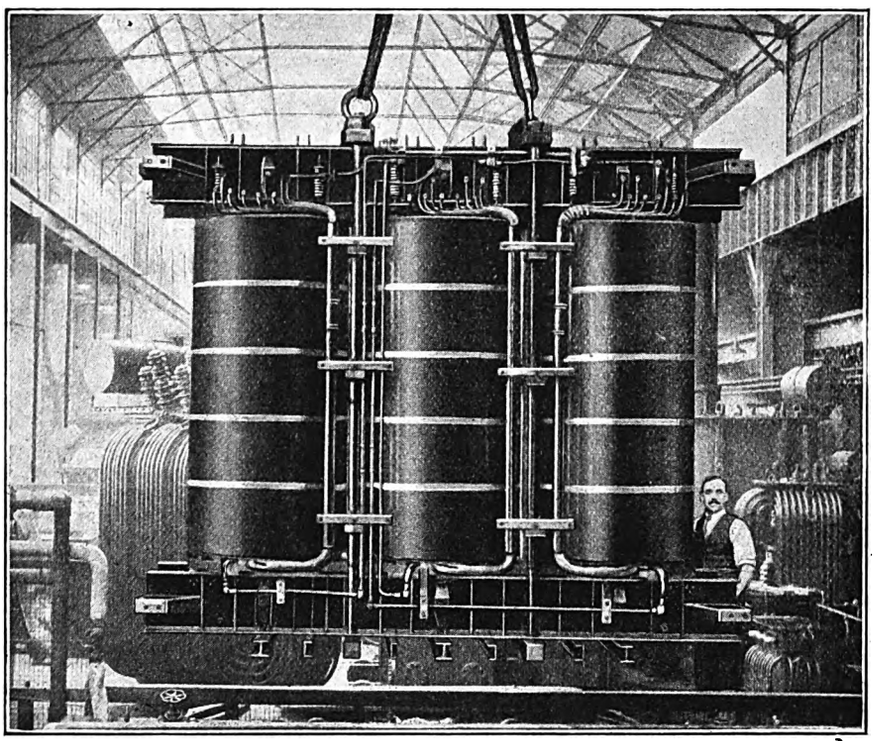
SOUTH-EAST ENGLAND GRID

26 THREE-PHASE

TRANSFORMERS

15,000 kVA, 132,000 VOLTS,

50 PERIODS.



One of the 26 three-phase Transformers for the South-East England Grid under construction at the Walthamstow Works.

FULLER ELECTRICAL & MFG. CO., LTD.,

ASSOCIATED WITH

ASEA ELECTRIC LTD.

5, Chancery Lane, W.C.2. - - Works : Walthamstow.

Telephone: HOLBORN 6001 (5 lines). *Telegrams: "FULLMAGE, FLEET, LONDON."*

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DI-ELECTRIC STRENGTH

3352 VOLTS PER MIL

and after 48 hours' immersion in water

2784 VOLTS PER MIL

SPECIFIC RESISTANCE

$5{\cdot}9 \times 10^{14}$ w/cm³

ARE OFFICIAL TEST READINGS OF

213 "ARMACELL"

Heat and Humidity dangerously lower the di-electric strength of : most insulating varnishes :

213 "ARMACELL"

ENSURES SAFETY

AT ALL WORKING TEMPERATURES AND UNDER VERY EXACTING CONDITIONS.

When heated from 15° to 90° C. its di-electric strength **falls only 18·5%**

When immersed 48 hours in water its di-electric strength **falls only 17%**

The Insulation Resistance of

213 "ARMACELL"

EQUALS THAT OF GOOD RUBY MICA.

HIGH TENSION OIL WATER

No. 1255B "Ohmaline"

(BLACK INSULATING VARNISH)

MEETS EVERY NEED.

Di-electric Strength **1500 Volts per mil.**
Falls after 48 hours in water **only 3·3 per cent.**

HOT-OIL PROOF.

"SHAYDOLITE"

LAMP LACQUERS SURPASS

ALL SPRAYED LAMPS FOR RICHNESS OF COLOUR.

A wide range of Colours in Clear, Opal & Frosting Finish

APPLIED IN A MINUTE.

"INSULDERM" ENAMEL

HEAT-RADIATING

OIL-PROOF. FLEXIBLE.

Prevents Sparking at Commutator Ends.

Breakdown Voltage 3600 Volts p·0·1 mm.

Suitable for HARD-WORKED TRACTION MOTORS

"We never had a breakdown with 'INSULDERM'"

said a New Zealand Tramway Co. after 'Insulderm' had overcome constant trouble.

Also for coating Cotton-Covered and Enamelled Wire.

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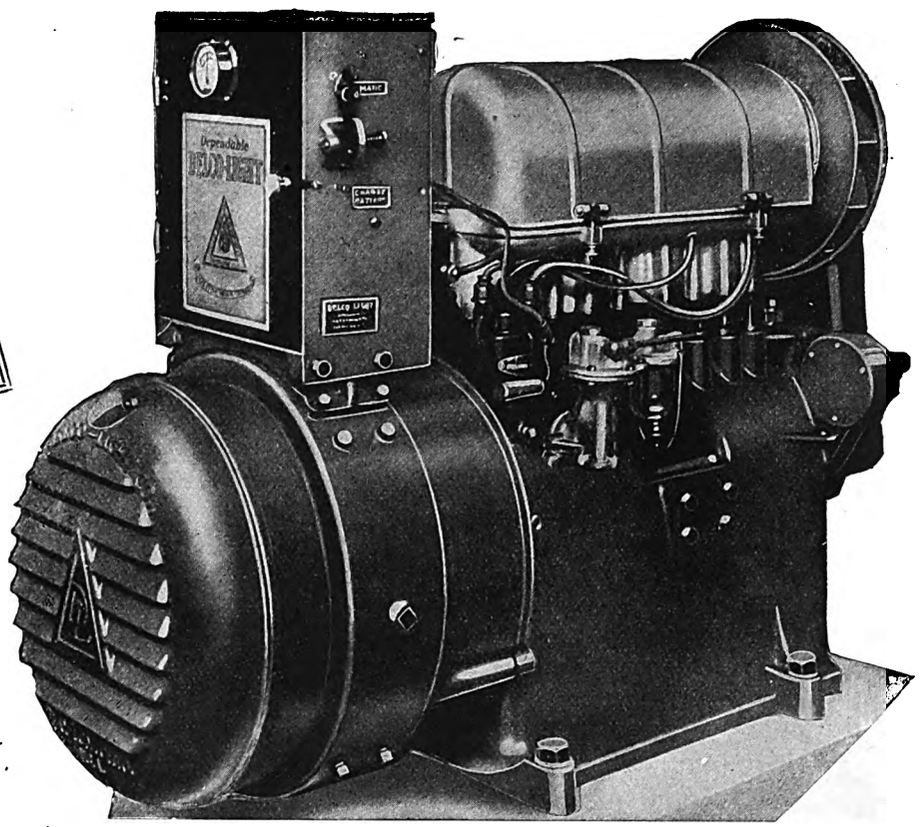

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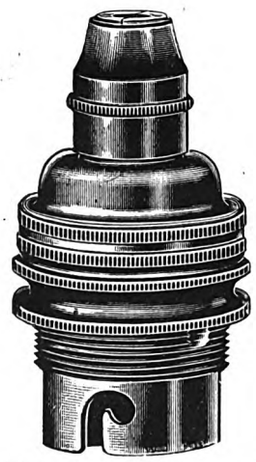

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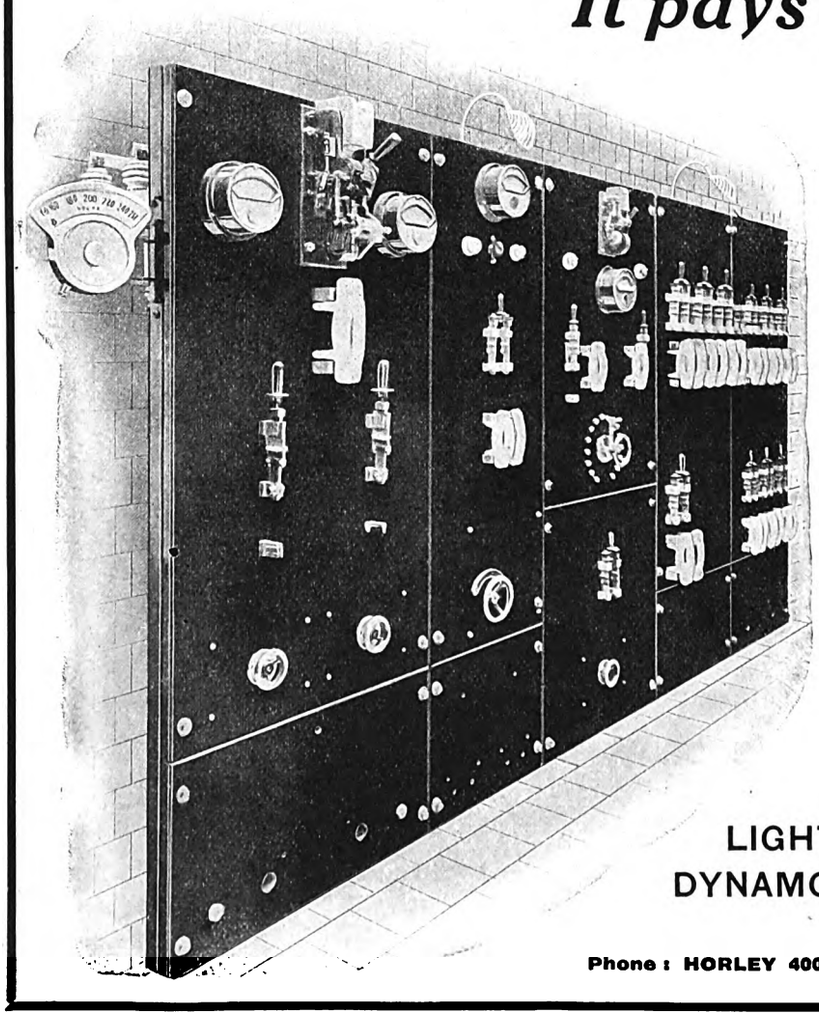

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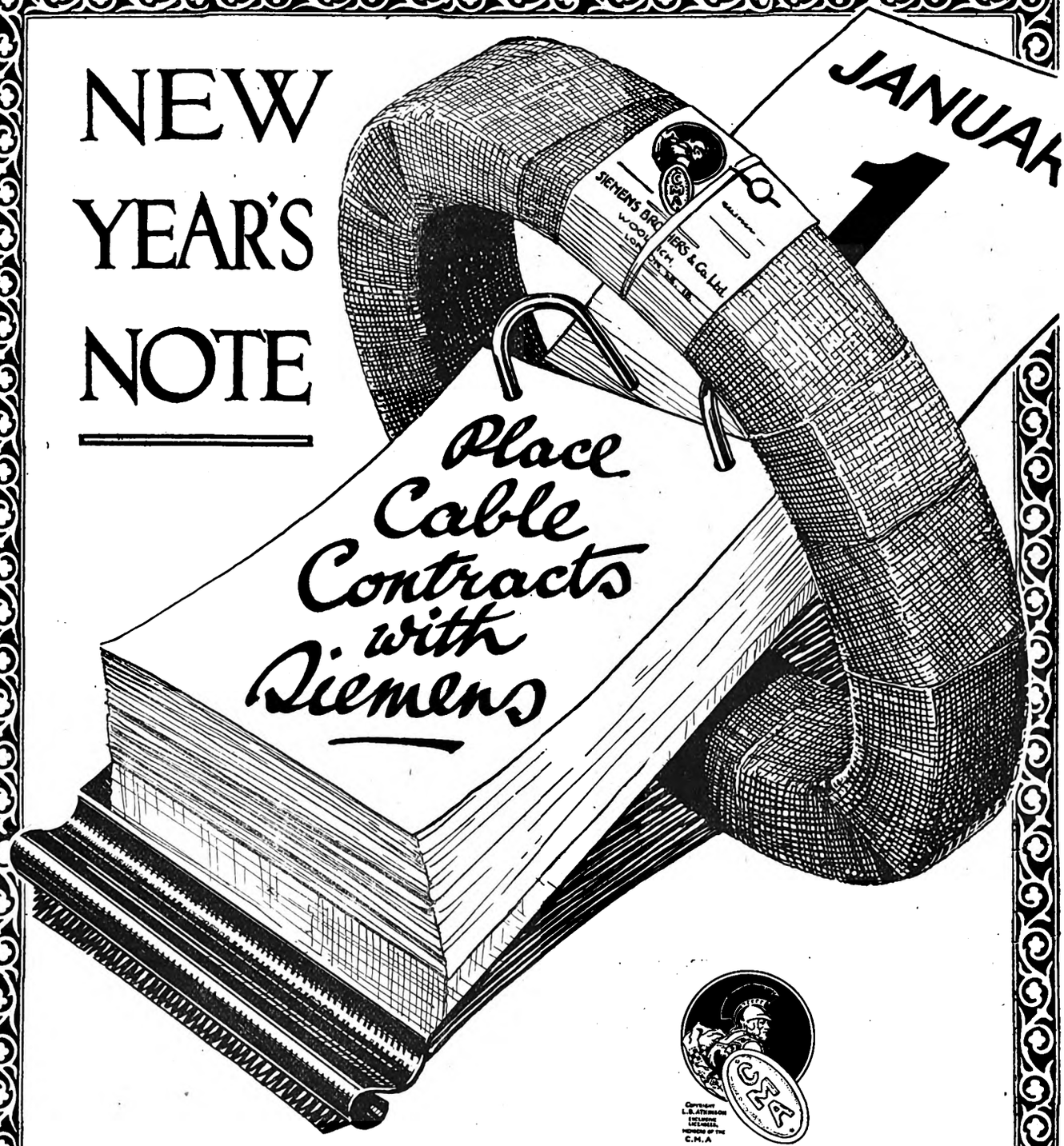

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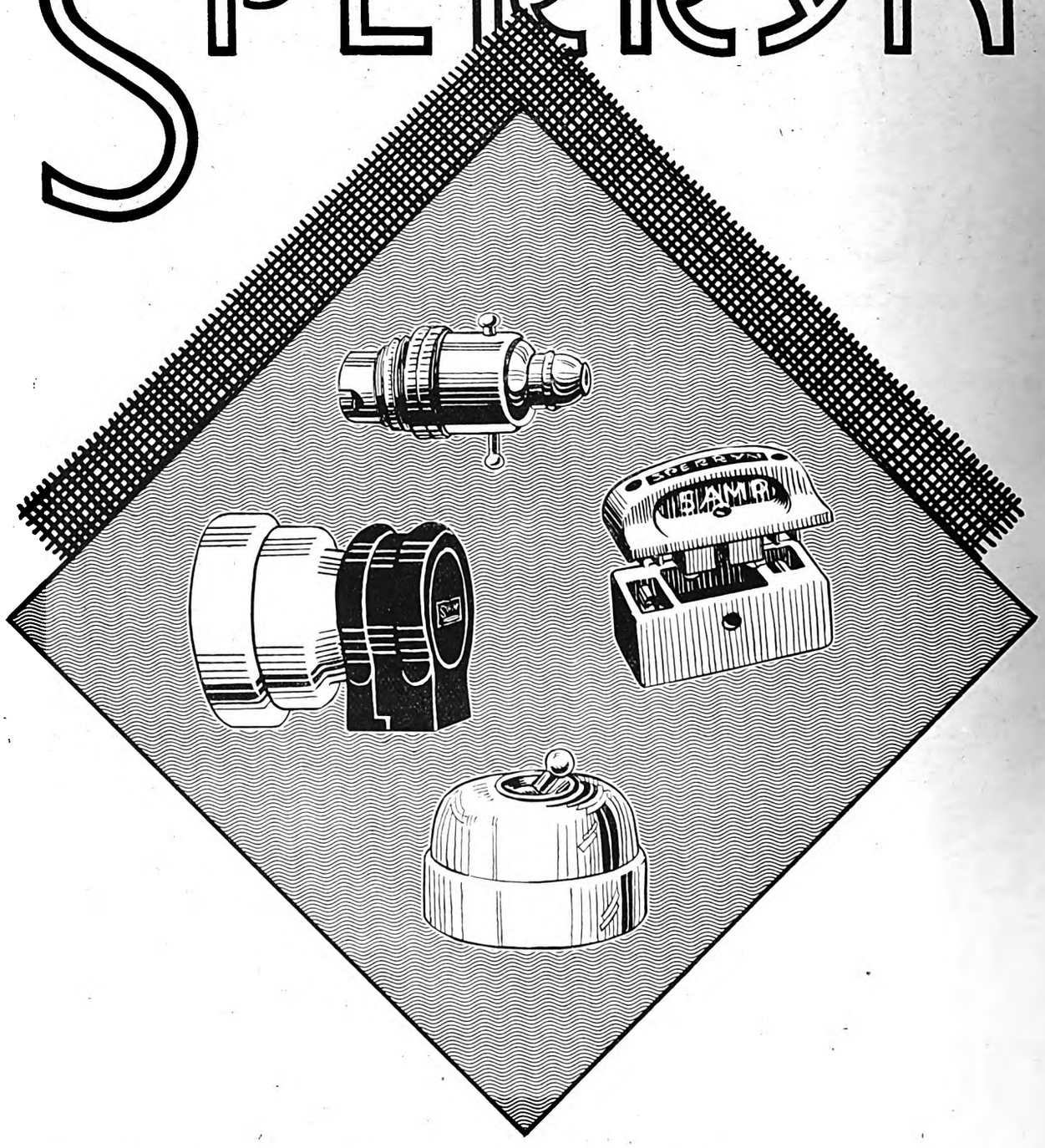

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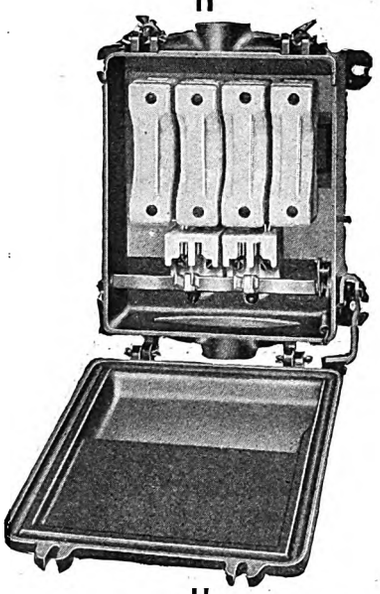

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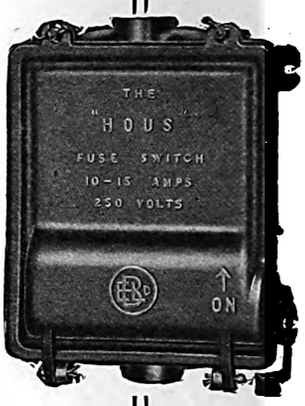

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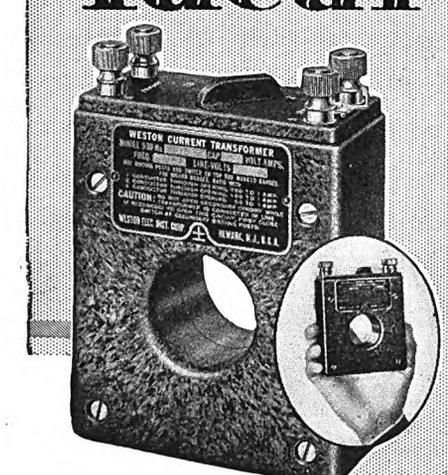

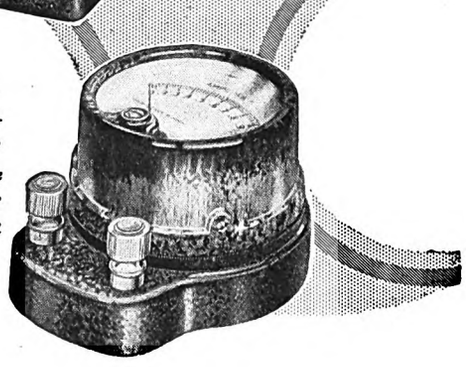

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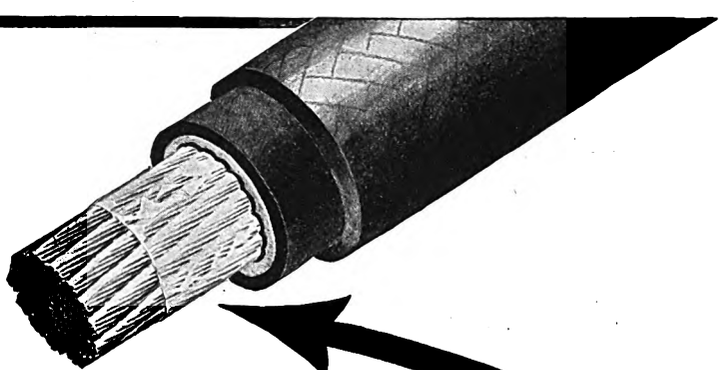

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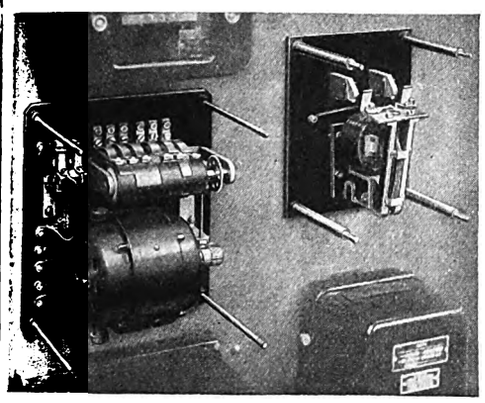

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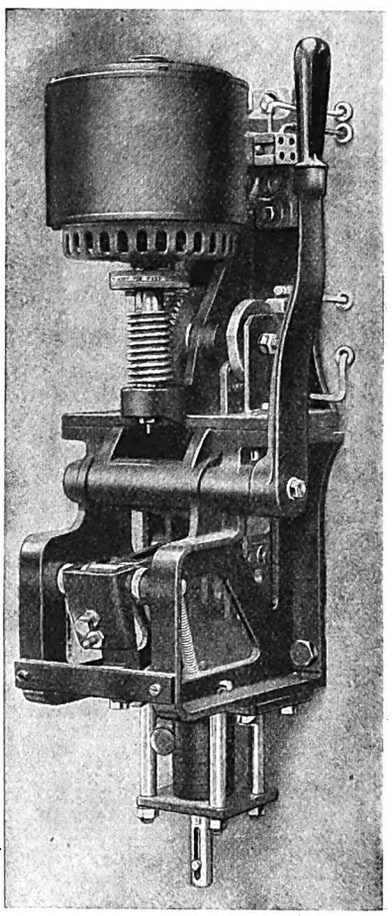

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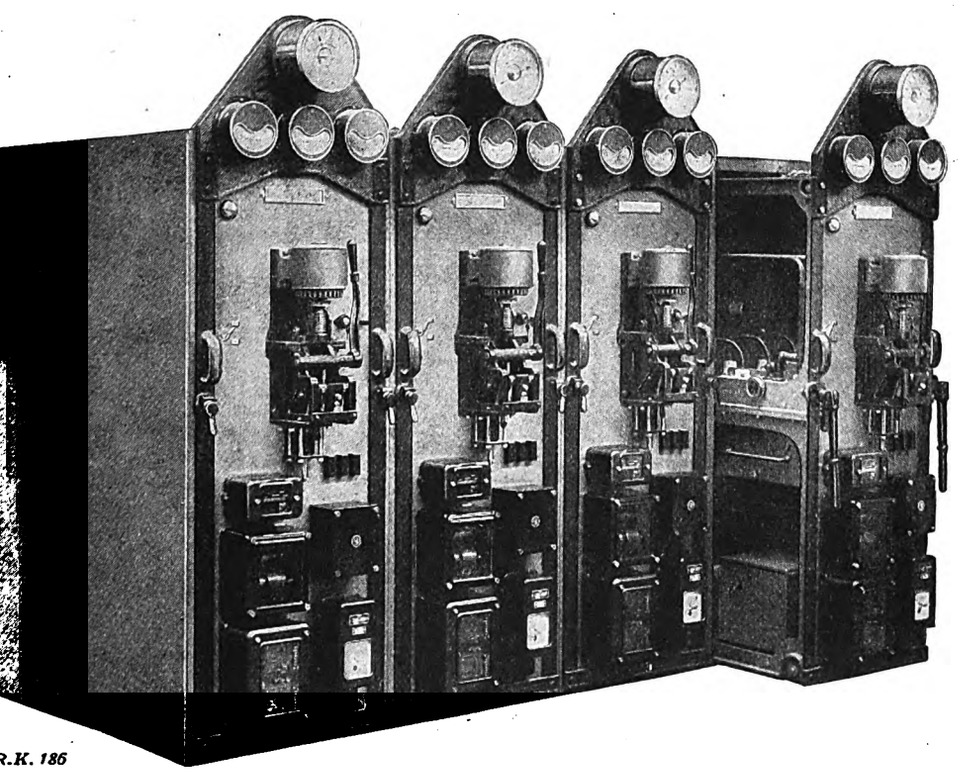

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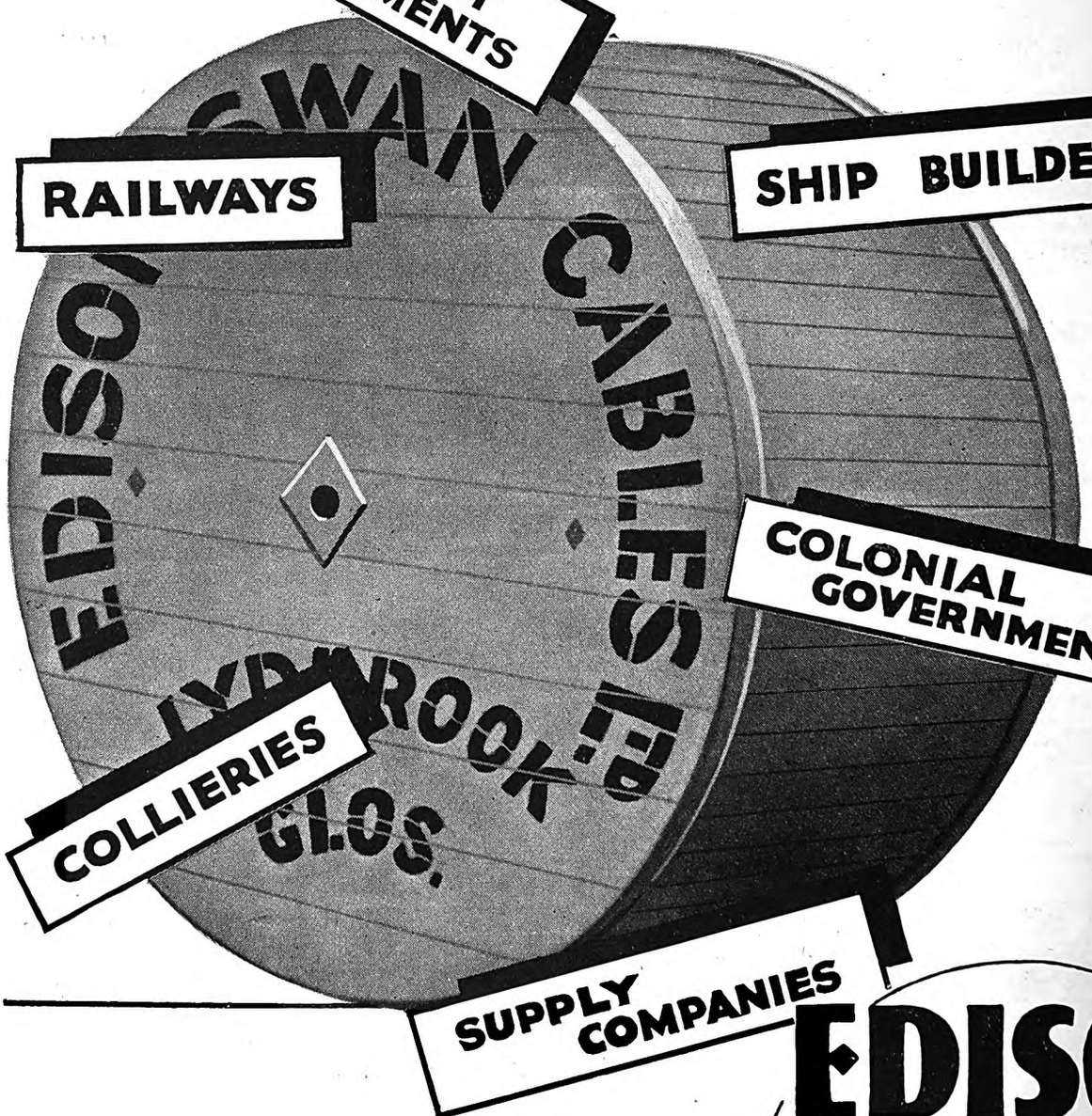

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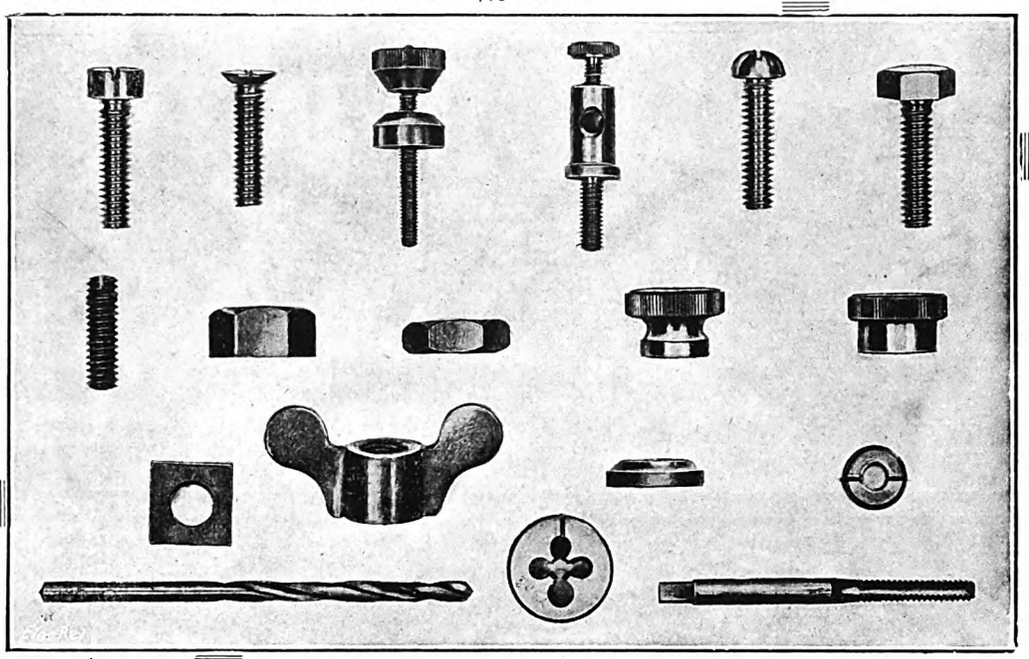

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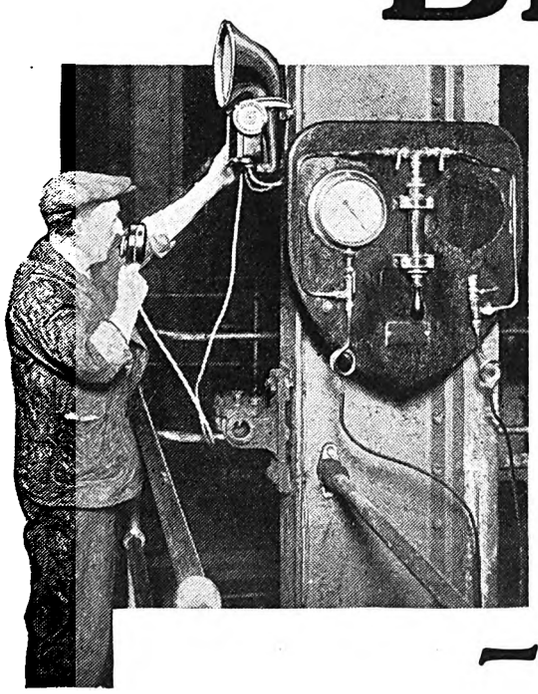

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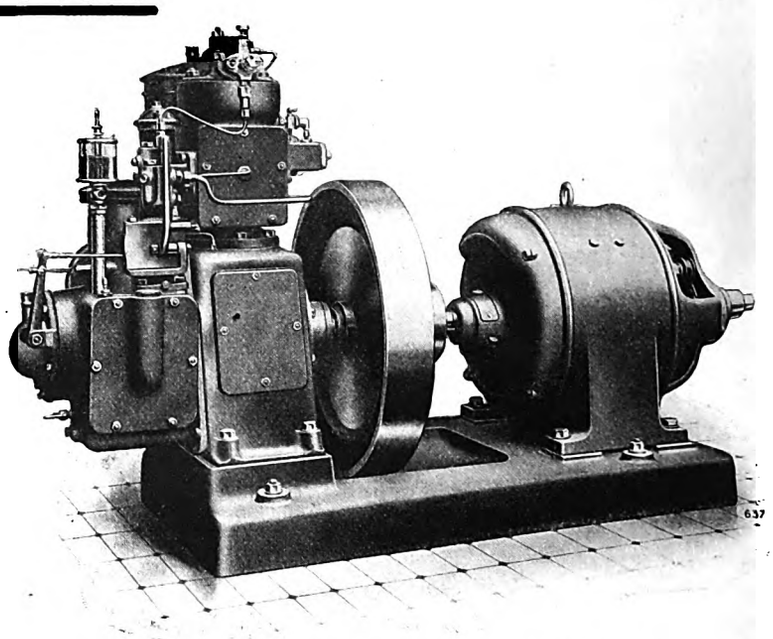

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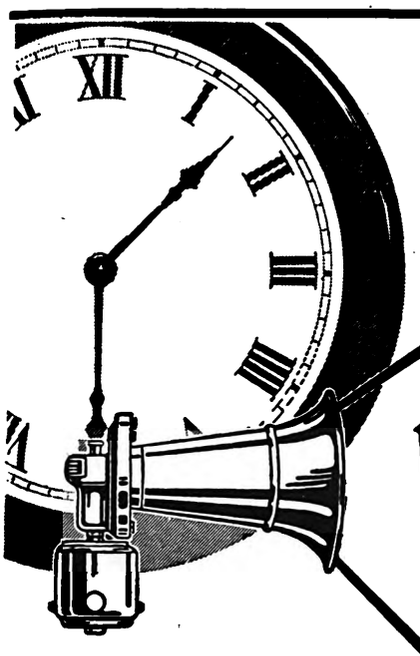

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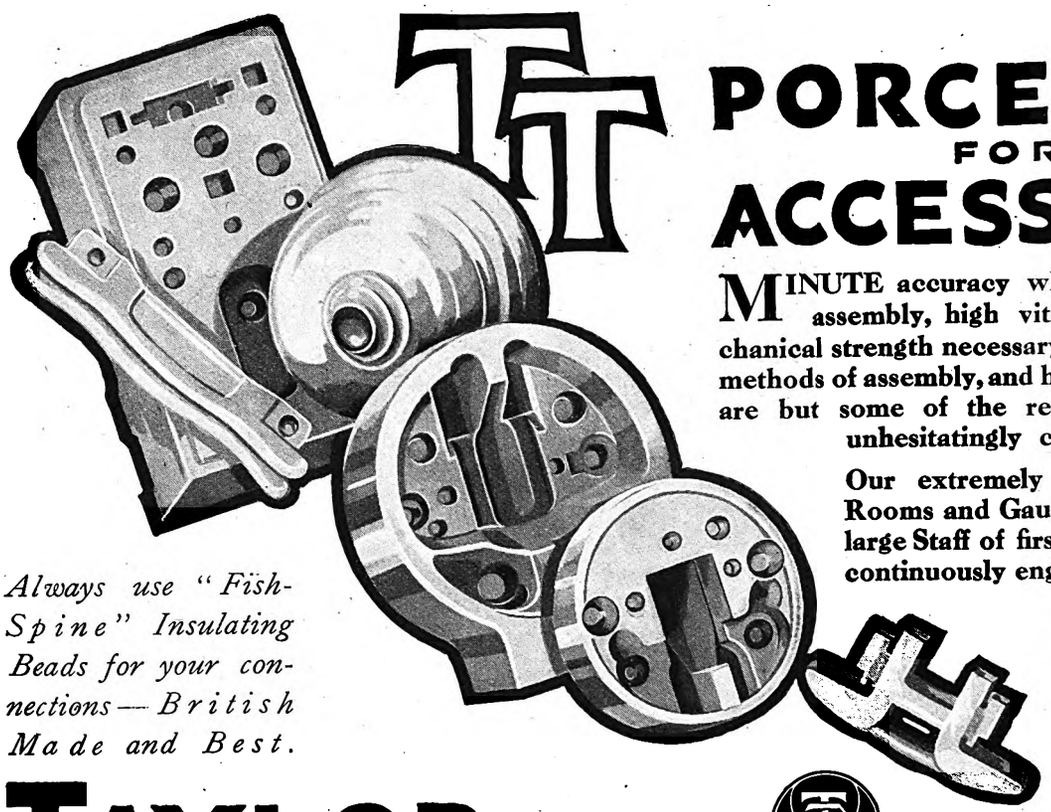

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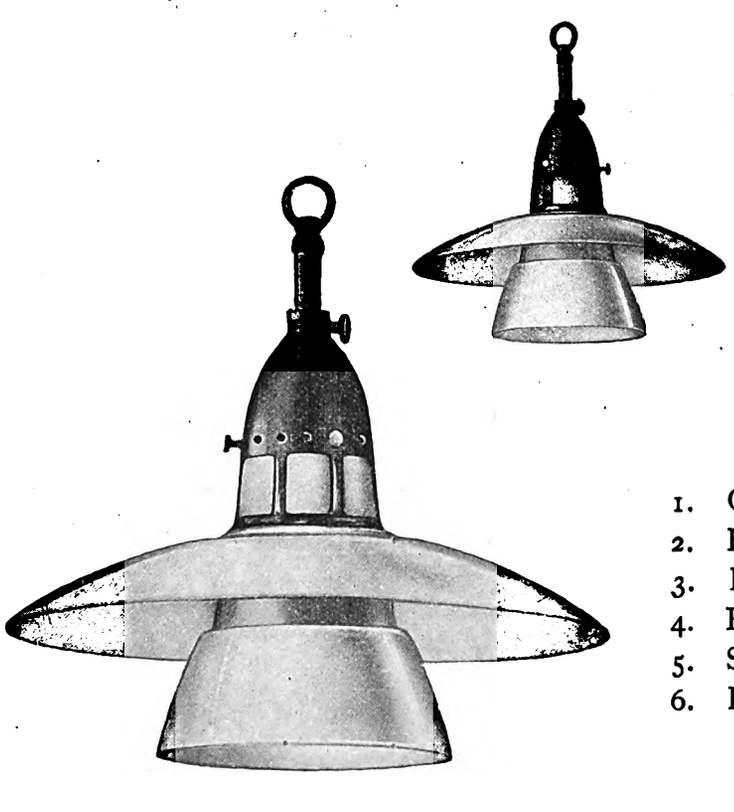

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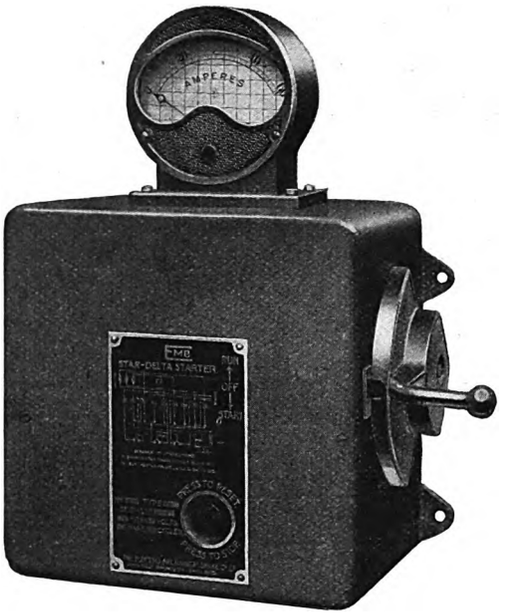

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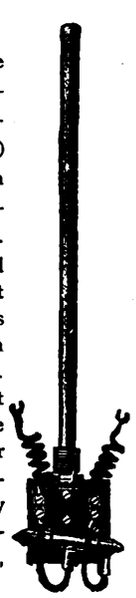

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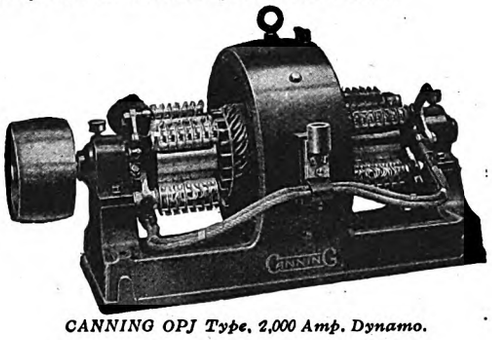

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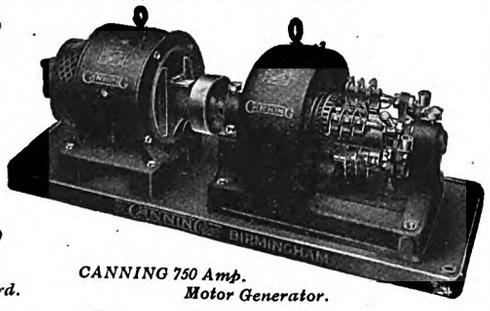

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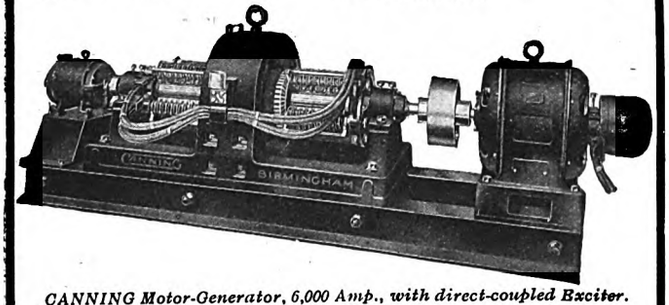

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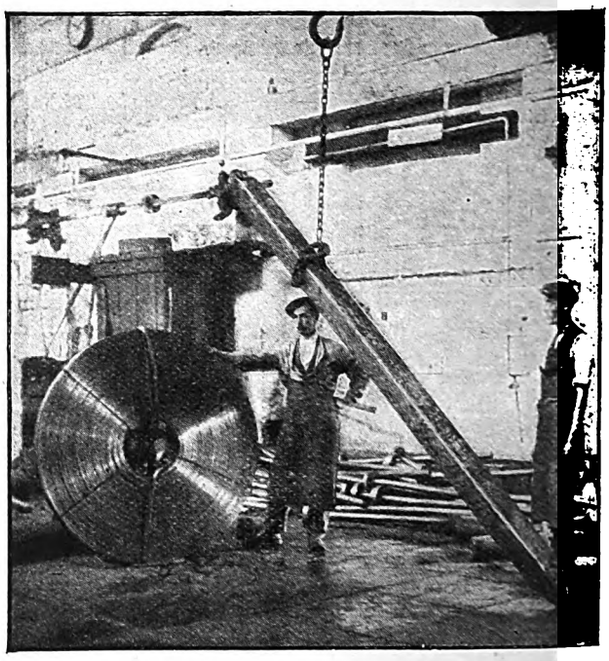

Coil weighing 15 cwts., and one of the ingots from which such strip is produced.

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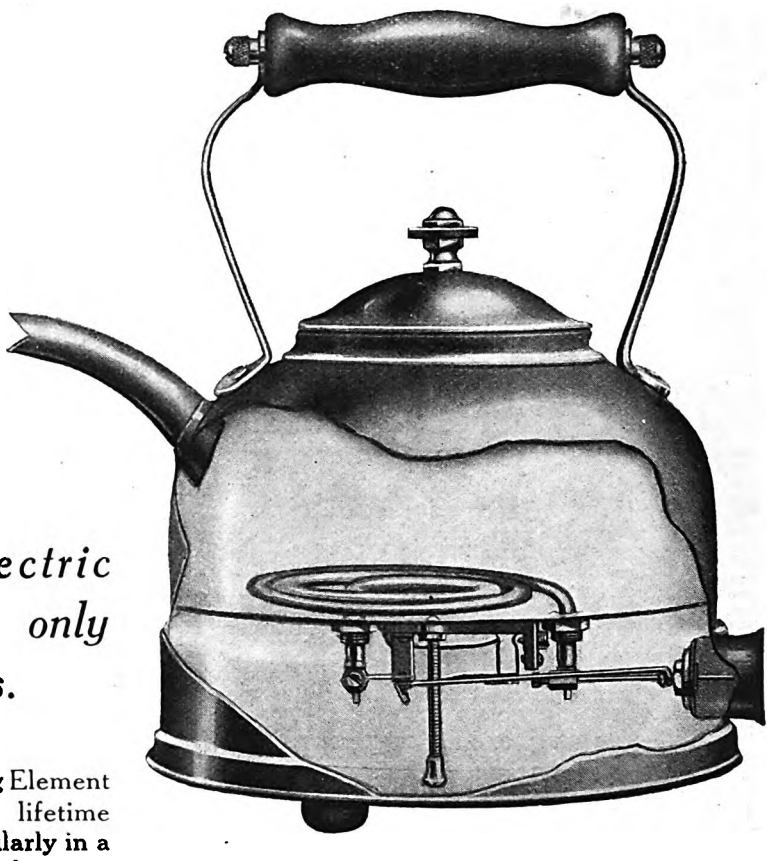
SUPER-AUTOMATIC

Electric Kettle

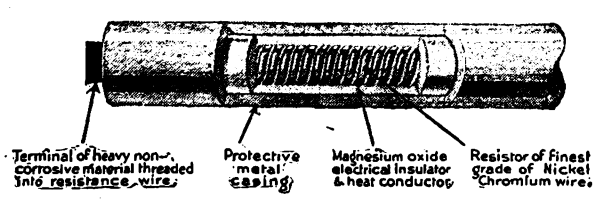
with the CALROD Element



The CALROD Electric Heating Element — Used only in Hotpoint Products.

THE patented CALROD Electric Heating Element represents the culmination of a lifetime endeavour to perfect electric heat. Particularly in a domestic electrical convenience continuity of service under all sorts of conditions is of paramount importance. It builds customer appreciation of the convenience and dependability of electric service. Thus, it creates goodwill for the Electrical Contractor and the Central Station.

This sectional view shows the typical construction of CALROD



Hotpoint Super-Automatic Thermal Protector Prevents Overheating

IF the kettle should be forgotten and allowed to boil dry, or if the current should be switched on before water has been added, the Super-Automatic Thermal Protector automatically breaks the circuit before any damage is done. When the kettle cools again the switch automatically closes, but if the kettle is still dry the switch opens again immediately. This cycle of operation will be repeated without damage to the kettle, for an indefinite time, or until such time as water is put in the kettle or the plug is disconnected. This Super-Automatic Thermal Protector is an exclusive Hotpoint feature.

This kettle is only suitable for use on A.C. circuits.

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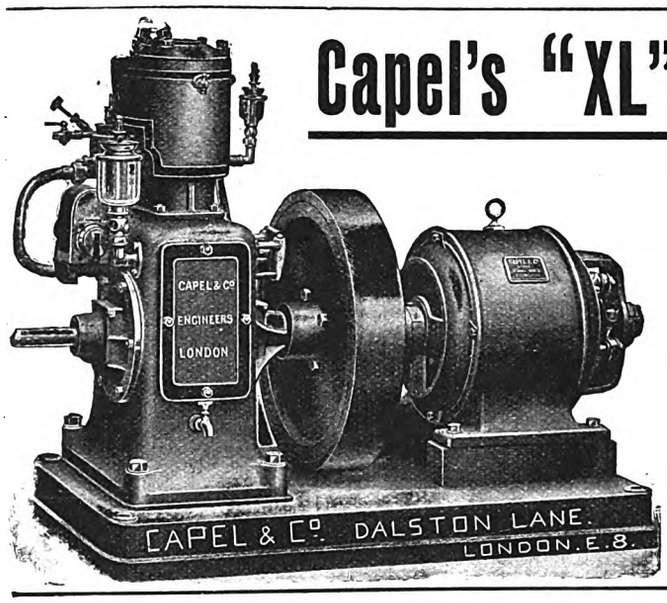

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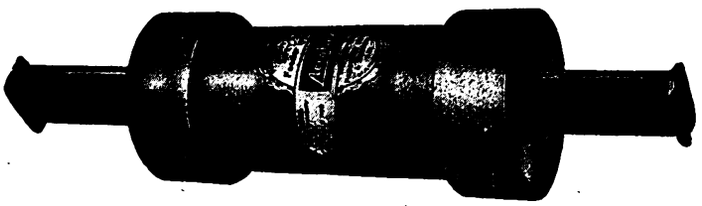

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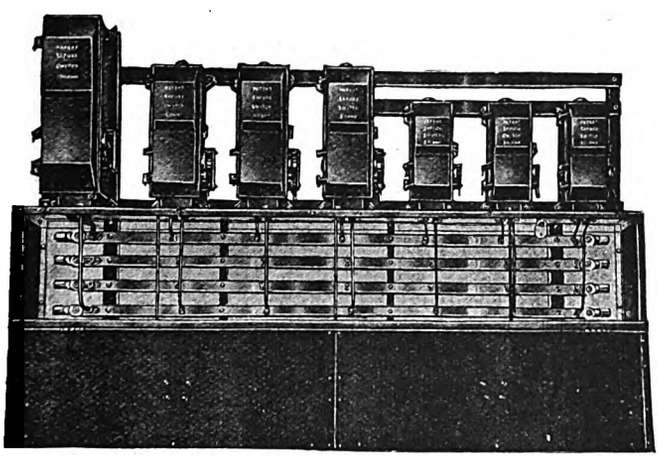

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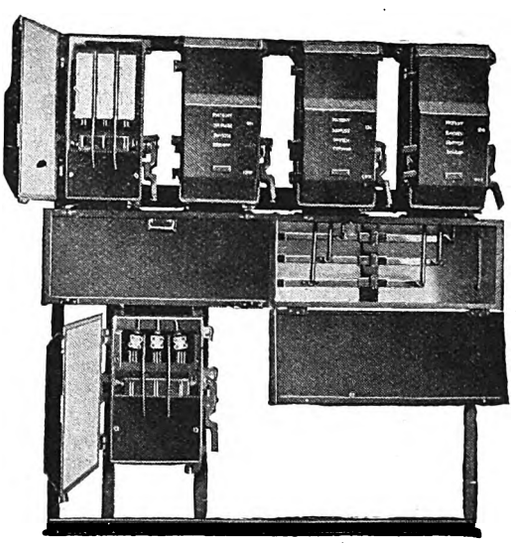

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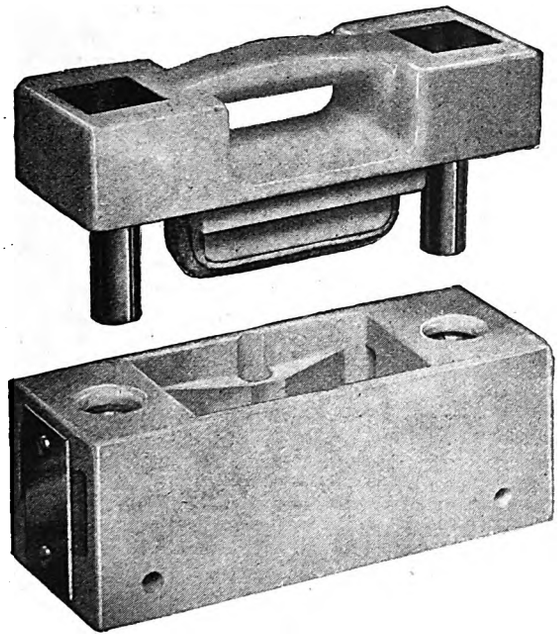

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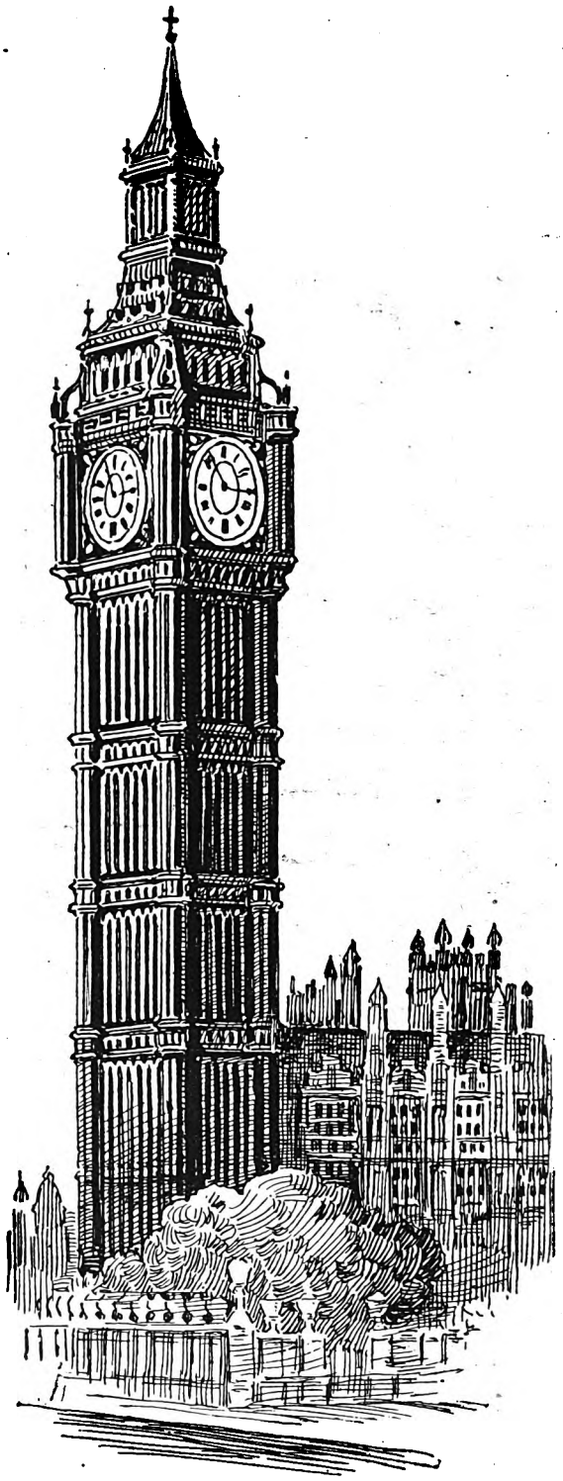

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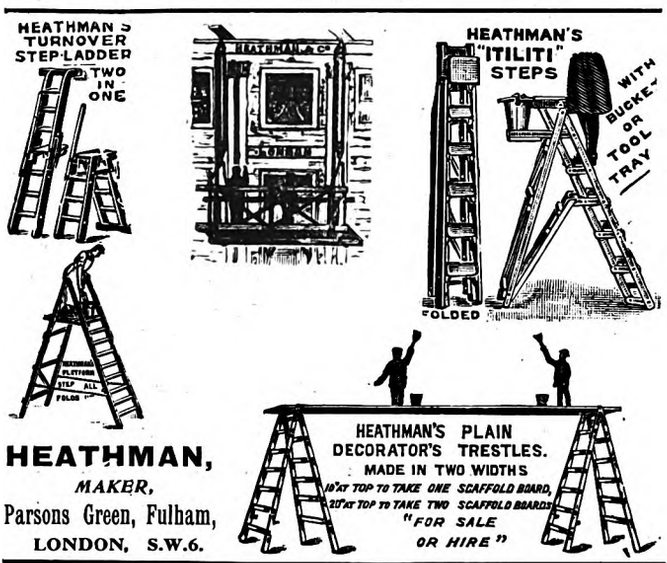

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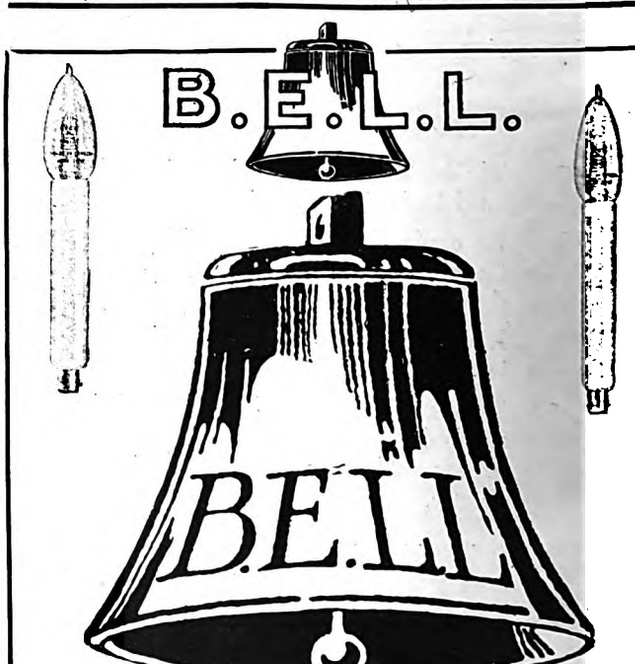

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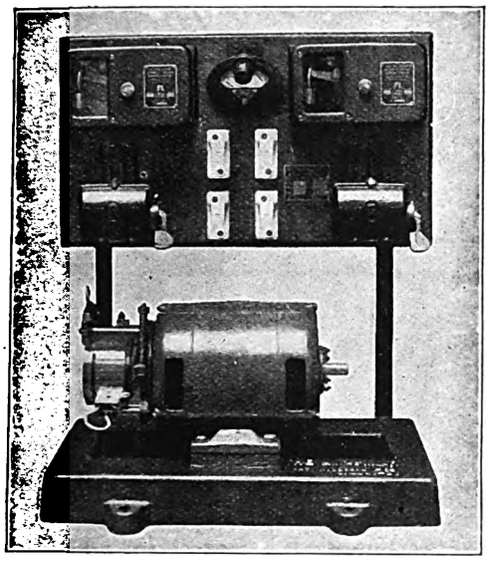

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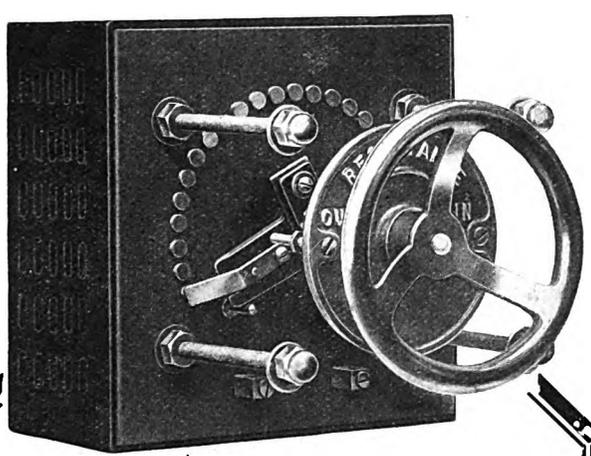

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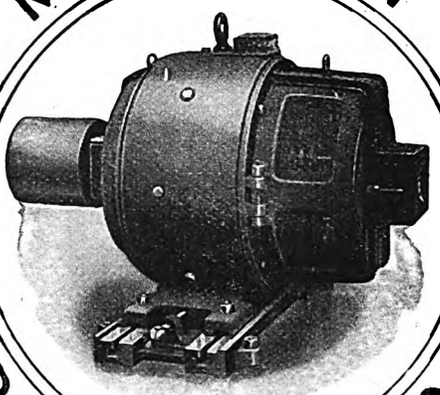

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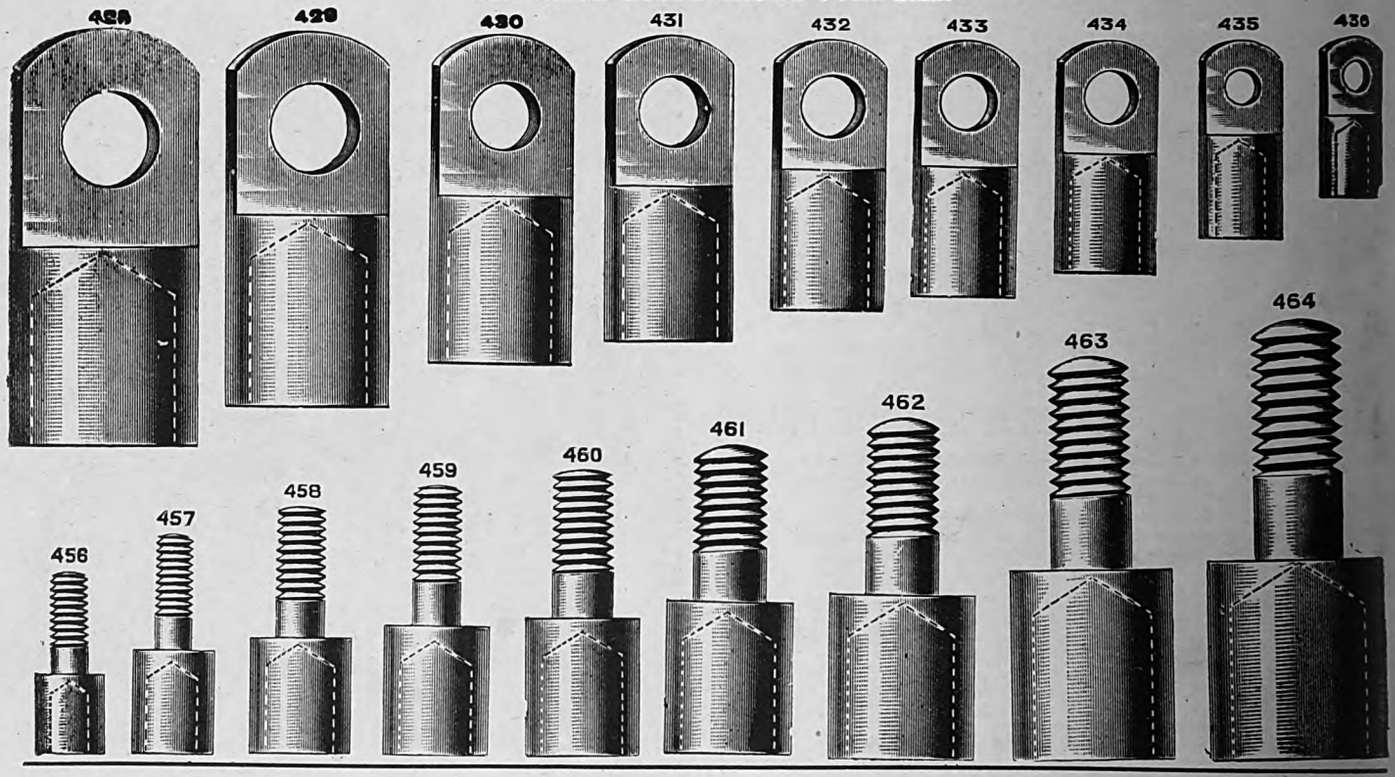

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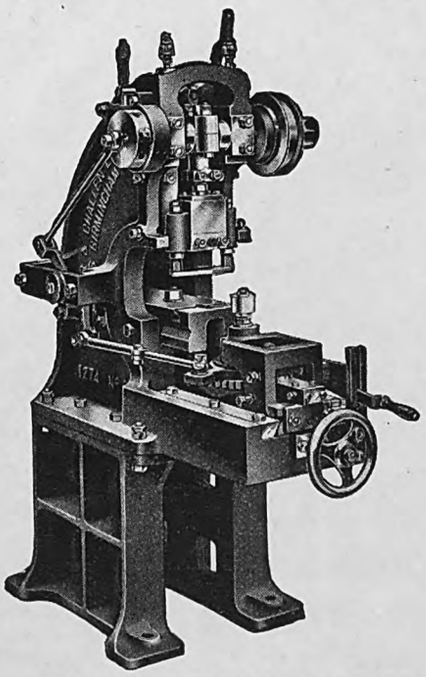

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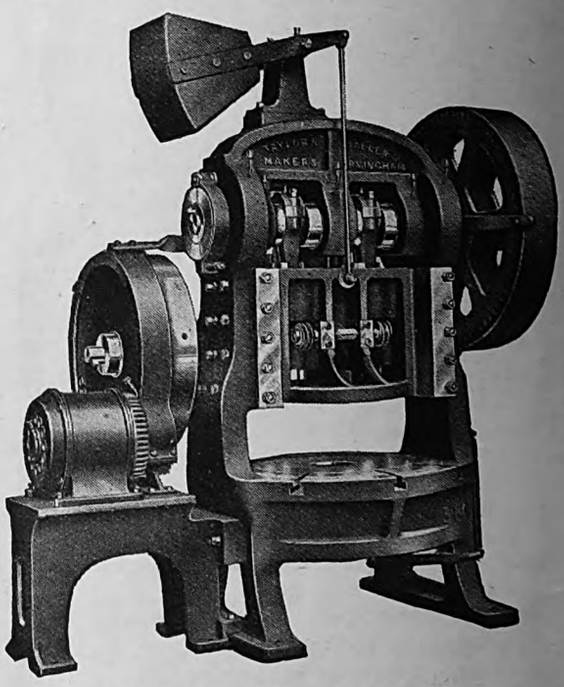

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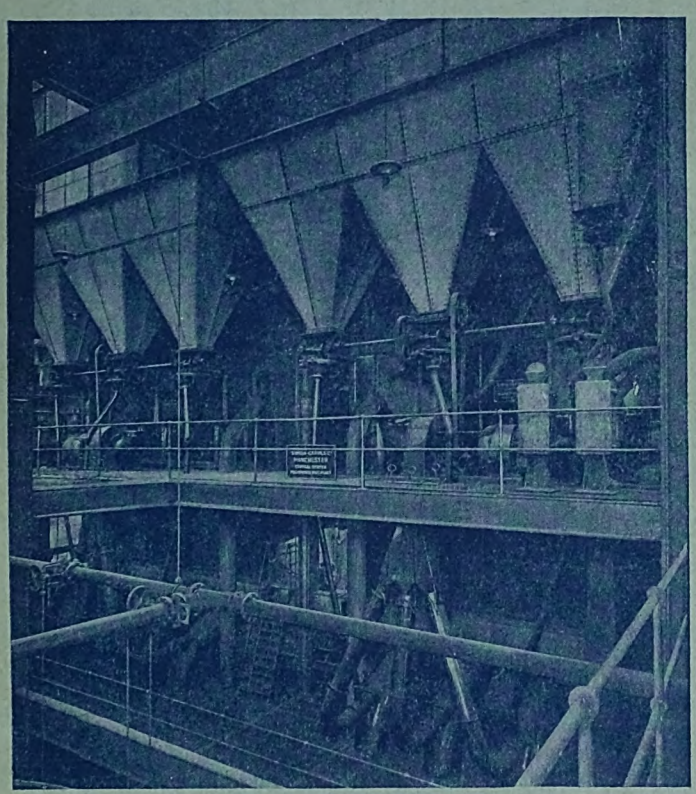

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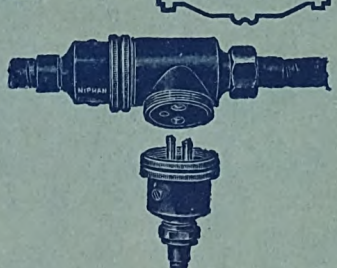

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